CrsMgr - The COURSE MANAGER SYSTEM

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ABSTRACT

CrsMgr - The Course Manager System

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CrsMgr, The Course Manager System, is developed as our contribution to the free open source community. It is a web-based application for managing the administrative tasks and information for university level courses. The system is designed with the role-based access control (RBAC) approach; a user of the system could have multiple system access roles. There are 10 system access roles; they are System Administrator, Department Administrator, Course Coordinator, Course Instructor, Thesis Supervisor, Course Student, Course Marker, Course Tutor, Lab Tutor, and Graduate Student. The system provides a wide range of functionalities for each of these access roles. For example, a course instructor can manage information such as student list, student submissions for assignments, student grades, project groups, teaching materials, and online assessments. For student users, it provides functionalities to access course materials, to upload assignments and get feedback for their works, to form project groups and conduct peer reviews for group works, and to take online assessments. For markers, it provides features to grade assignments and projects and to give feedback online, hence the usage of paper is eliminated.

The system is designed and implemented with typical three-tier client-server architecture, which consist of the user interface tier, the processing management tier, and the database management tier. The client side user interface tier is made up of HTML pages, and the server side database management tier uses MySQL as the DBMS. In between these two tires is the processing management tier, which uses PHP as the scripting language.

Acknowledgments

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Finally, I would like to thank my parents and my parents-in-law for their patience and encouragement when I encountered difficulties.

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Chapter 1

Introduction

1.1 Problem Statement

The traditional course management tasks involve a lot of paper work which is fairly inefficient and environmentally unfriendly. Let's take a look at the typical steps that a course instructor needs to perform for a course assignment. First, he prepares his assignment and makes paper copies for each student in the class; he carries these copies to the class and distributes them to the students. There is always a problem of delivering the paper copies to the absent students. After the students finish the assignments on more paper, the instructor collects them in class and brings them back to mark them. Once all the assignments are marked, the instructor brings them back to the class and hands them back to the students by calling each student's name. The marked assignments for the absent students are returned to the office and to be delivered in the next class. This is just a simple example to show how inefficient the traditional course management is. Furthermore, information in traditional course management is hard to maintain and update. For instance, it will be difficult for a course instructor to look for a student's midterm exam taken several years ago. These problems motivate our work here to design and implement a course management system to free course instructors from the inefficient paper-based traditional course management. CrsMgr, The Course Manager System, is a web-based tool for managing teaching relevant tasks and information.

1.2 Proposed Solution

CrsMgr, The Course Manager System, is a free web-based application for managing teaching relevant tasks and information for university level courses. It is developed as our contribution to the open source community.

The CrsMgr system is designed based on the role-based access control (RBAC) approach, an approach to restrict system access to authorized users based on the roles that users assume in a system rather than the user's identity [1, 2]. In CrsMgr, a user of the system could be a professor user or a student user based on the user's identity. The system access privileges are controlled by 10 system access roles, which are divided into two groups of 5 roles each; they are the administrative roles and the student roles. The group of administrative roles includes System Administrator, Department Administrator, Course Coordinator, Course Instructor, and Thesis Supervisor. The group of student roles includes Course Student, Course Marker, Course Tutor, Lab Tutor, and Graduate Student. The administrative roles are assigned to the professor users and the student roles are assigned to the student users. A system user could have multiple system access roles. For instance, a professor user could be a Course Coordinator, a Course Instructor, and a Thesis Supervisor at the same time.

The system provides a wide range of functionalities for the users with different access roles. For example, for a coordinated course with multiple sections, the course coordinator is allowed to create shared course material for the course during the term. A course instructor can manage information such as student list, student submissions for assignments, student grades, project groups, teaching material, and online assessments. A course student can access the course material and take online assessments for a course

that he is registered. As for a thesis supervisor, it provides features to manage the projects and graduate students under her supervision.

Over the last 5 years, the system has been used to manage a number of courses in computer science department of Concordia University and the system has evolved from the early version 1 to the current version 2. Compared to the previous versions, the current version of CrsMgr, which is the contribution of this thesis, is greatly enhanced on both usability and reliability.

First, the system access control has been enhanced with the RBAC method in the current version of CrsMgr. In the previous versions, the feature of multiple access roles for a user was not implemented; to have multiple access privileges, a user needs to be assigned a separate user account for each access role. The old versions of CrsMgr support only four access roles; they are System Administrator, Course Instructor, Course Marker, and Course Student. In the current version of CrsMgr, which is designed with RBAC approach, a system user could have multiple access privileges using a single user account. Six new access roles have been added to the system; they are Department Administrator, Course Coordinator, Course Tutor, Lab Tutor, Thesis Supervisor, and Graduate Student. A user could only access the functionalities associated with his assigned role(s). This RBAC method enhances the security and performance of the system.

Second, many new features and improvements to the existing features are added to the current version of CrsMgr. As the functionality associated with the Course Coordinator role, the multiple sections course coordination is realized in the current version of the system. For the course group management, the online group-forming, group leader voting, and more flexible peer-review features have been added to the system. The grading

system has been improved with the options of error correction for assessments, mark substitution, and group work evaluation based on peer review(s). To ease the jobs of the instructors, question banks are provided to store the assessment questions that could be reused for future assessment creation. As an important part of the system, the online assessment system is also improved greatly. In the previous versions of CrsMgr, an assessment question could have only one version; students are not allowed to defer a difficult assessment question during an online assessment. In contrast, in the current version of CrsMgr, an assessment question could have multiple versions; both the question version and answer are shuffled to reduce the possibility of cheating during an online assessment. Furthermore, students are now able to defer or bank some of the assessment questions and retry them later. In addition, for an online assessment, an instructor is able to set special time windows and exam durations for the students who are in special needs.

Finally, the current version of CrsMgr is more user-friendly than the previous versions. In the previous versions, a user with multiple access privileges must open one login session for each of his access privileges using different user accounts. In contrast, the current version of CrsMgr allows a user to switch among his multiple access roles within a single session. Moreover, the new user interfaces are designed using template; online helps and instructions are provided throughout the pages of the current version of the system.

1.3 Thesis Outline

The rest of this thesis is organized as follows. Chapter 2 introduces some background about the development history of CrsMgr and highlights some existing course management applications. In chapter 3, the system architecture and database design of

CrsMgr is presented. Chapter 4 describes the detail functionalities of CrsMgr. Finally, in Chapter 5, we draw our conclusions on the contribution of the thesis and outline some future work. The appendix gives the details for the database tables used.

Chapter 2

Background and Related Work

2.1 Development History of CrsMgr

Started in 1998, as a course project of COMP490 in Concordia University, the initial frame work of CrsMgr, The Course Manager System, was designed under the supervision of Professor Bipin C. DESAI. This project was continued during the years that followed. Around year 2003, basic functionalities for course management were developed for CrsMgr version 1 and the system was applied to manage a number of courses in computer science department including SOEN282, COMP346, COMP352, COMP353, COMP451, and COMP5531. However, during the production use of CrsMgr version 1 since 2003, the need for more new features emerged. Also, bugs were found and improvements were needed to be made. The original design was no longer able to meet these additional requirements. As a result, a major redesign and rebuilt process was called for CrsMgr version 2. This process was started in year 2005. In May 2006, the rebuilt version 2.0 of CrsMgr was released and has been used to manage the courses Comp353 and Comp5531.

As was described in Chapter 1, compared to the previous versions, the current version of CrsMgr is greatly enhanced on both usability and reliability.

2.2 Existing Course Management Systems

There exist a number of similar course management systems (CMS). Most of them are commercial products, such as WebCT and FirstClass [3, 4]. Considering the huge gaps in the resources invested in the development of the systems between the commercial ones and non-commercial ones, we will not compare CrsMgr with these products because it will not be fair. As a result, only those free, open source applications such as Moodle and LON-CAPA are compared with CrsMgr. However, unlike CrsMgr, both Moodle and LON-CAPA are supported by a large group of independent developers [5, 6].

Moodle is a free, open source course management system designed to help educators create effective online learning communities [5]. The Moodle project was started by Martin Dougiams, a webmaster at Curtin University of Technology in 1990's. It has a large user community with over 200,000 registered users who speak 75 languages in 175 countries.

LON-CAPA is a free, open source distributed learning content management system with particular emphasis on automated assessment. It is a product of two individual projects, the CAPA project and the Lecture Online project in 1999 at Michigan State University. It has a content-sharing network of over 70 participating institutions in United State [6].

Based on the criteria used by EduTools [7], a system that provides independent reviews and side-by-side comparisons on different CMS, we make some comparisons of Moodle, LON-CAPA, and CrsMgr on hardware/software requirement, administrative tools, communication tools, student involvement tools, course delivery tools, and productivity tools.

- **Hardware / Software Requirement**

	Moodle	LON-CAPA	CrsMgr
Web Browser	Major web browsers	Major web browsers	Major web browsers
Operating System	UNIX/Windows	UNIX	UNIX /Windows
Database	Oracle MySQL MS SQL Server PostGreSQL	MySQL	MySQL

Table 2.1 Comparison on Hardware/Software Requirement

- **Administrative Tools**

	Moodle	LON-CAPA	CrsMgr
Access Role Authorization	Yes	Yes	Yes
Batch Registration	Yes	Yes	Yes
Self-Registration and Guest Access	Yes	Yes	No

Table 2.2 Comparison on Administrative Tools

All three systems support restrictive system access based on the access roles and a user could have multiple access roles. Also, all three systems support batch insertion of students to the system using a delimited text file. However, currently, student self-registration and guest access are not supported in CrsMgr since it is designed for traditional registered course management.

- **Communication Tools**

	Moodle	LON-CAPA	CrsMgr
Discussion Forum	Yes	Yes	No
File Exchange	Yes	Yes	Yes
Internal Email	Yes	Yes	Yes
Online Journal/Notes	No	Yes	Yes
Real Time Chat	Yes	Yes	No

Table 2.3 Comparison on Communication Tools

In CrsMgr, instructors are able to upload files for different types of teaching tasks such as assignment and course notes; students are allowed to upload submission files for the assignments/projects. The course instructors or course coordinators are allowed to send teaching emails to predefined user groups.

- **Student Involvement Tools**

	Moodle	LON-CAPA	CrsMgr
Course groups	Yes	Yes	Yes
Group Leader Vote	No	No	Yes
Peer Review	No	No	Yes
Student Portfolio	Yes	Yes	No

Table 2.4 Comparison on Student Involvement Tools

Although all the three systems feature course groups, only the students in CrsMgr are allowed forming a group by themselves; in Moodle and LON-CAPA, students are assigned to the groups by the instructors. CrsMgr allows the students to lock their course group so that no other students can join their group. In addition, CrsMgr allows students to vote for their group leaders. As part of its grading system for group assignments, CrsMgr uses a peer review feature to determine the contribution of individual group member in performing a group assignment; the other two systems lack this feature. The instructors in CrsMgr could require the students to perform a single peer review for all the group works for a course or to require peer review for each group work. In Moodle and LON-CAPA, students can create a personal home page in each course; CrsMgr does not offer this feature.

- **Course Delivery Tools**

	Moodle	LON-CAPA	CrsMgr
Course Material Management	Yes	Yes	Yes
Online Assessment	• Multiple attempts are allowed • Question shuffle • Answer shuffle • Instructor cannot take a "dry run" of the assessment	• Multiple attempts are allowed • Question shuffle • Answer shuffle • Instructor cannot take a "dry run" of the assessment	• Multiple attempts are not allowed • Question shuffle • Answer shuffle • Random version • Instructor can take a "dry run" of the assessment
Question type	• Multiple choice • Multiple answer • Matching • Ordering • Calculated • Fill-in the blank • Short answer • Survey questions • Essay • Questions can contain other media elements (images, videos, audio) • Custom question types can be defined.	• Multiple choice • Multiple answer • Matching • Ordering • Jumbled sentence • Calculated • Fill-in the blank • Short answer • Essay • Questions can contain other media elements (images, videos, audio) • Custom question types can be defined.	• Multiple choice question with one or more correct answer • Short answer • Long answer • One question could have multiple versions • Questions can contain other media elements (images, videos, audio)
Question Bank	Yes	Yes	Yes
Online Marking and Grade Book	Yes	Yes	Yes

Table 2.5 Comparison on Course Delivery Tools

All the three systems features the five course delivery tools listed in the Table 2.5. In CrsMgr, instructors are able to control the release of different course material such as assignment, project, tutorial, and solutions by setting an associated "Disable/Enable"

switch. Students are allowed to take time limited online assessments during preset time windows set by the instructors. Online assessments are used in CrsMgr to evaluate the progress of the students and serve the purpose of quizzes of a traditional course offering. While multiple attempts on an assessment are not allowed in CrsMgr, the instructors can take a "dry run" of an online assessment before it's attempted by the students. During an assessment, both the questions and the answers could be shuffled. In CrsMgr, the assessment questions could contain multiple versions and different versions are randomly chosen for each student. This further prevents cheating. CrsMgr also allows students to "bank" questions which they find difficult for later retry. CrsMgr provides two question types, the multiple choice question and the normal question (short/long answer question). For the normal questions, the answers would be typed in a text box or uploaded in an answer file containing any media such as image, audio, or video. As the support for the online assessment, a question bank for each course is provided to store the assessment questions. All online or offline assignments, projects and assessments can be marked online, and the students can access their course grades and feedbacks through the online grade book.

- **Productivity Tools**

	Moodle	LON-CAPA	CrsMgr
Calendar / Event Poster	Yes	Yes	Yes
Searching Within Course	Yes	Yes	No
Help/Orientation	Yes	Yes	Yes

Table 2.6 Comparison on Productivity Tools

Both Moodle and LON-CAPA provide an online course calendar for instructors and students to post events; CrsMgr provides a calendar for meeting time slot reservations

and posts the events in the form of announcements. While users of Moodle and LON-CAPA are able to search all course content or discussion contents, a simple searching feature is provided in CrsMgr to search only the users by some keys. Although context sensitive help or online tutorial is not available, CrsMgr provides a large amount of help links and pages to its users as the other two systems.

Based on the above comparisons, we can conclude that the two mature course management systems—Moodle and LON-CAPA, which are both supported by a large group of system developers, is better in some features. However, CrsMgr system supports most of the essential course management for the traditional teaching task and information; it has its advantages such as the better course group management, the peer review feature, and the grading system based on peer review.

Chapter 3

Architecture and Database Model

3.1 CrsMgr Architecture

CrsMgr is designed and implemented with typical three-tier client-server architecture. The three-tier architecture (also known as the three-layer architecture) was introduced in the 1990s to overcome the limitations of the two-tier architecture [8-11]. It consists of the user interface tier on the client side, the database management tier on the server side, and the processing management tier in between.

Compared to the two-tier architecture, in which a client talks directly to a server, the three-tier architecture introduces a middle tier to provide process management, where business logic and rules are enforced. This middle tier enables the system to accommodate hundreds of users compared to a limited number of users with the two-tier architecture by providing functions such as queuing, application execution and database staging. The three-tier architecture provides increased performance, flexibility, maintainability, reusability and scalability, while hiding the complexity of distributed processing from the user; it has become a popular choice for web-based applications [10].

Figure 3.1 shows the architecture and components of CrsMgr. CrsMgr consist of five components: the web browser, the Apache web server, the PHP engine, the MySQL DBMS, and the local storage. The user interface tier consists of a web browser and the system access is based on the dynamic HTML pages displayed on the browser [12-14].

The HTML pages control the presentation logic of the application. The processing management tier of the application uses PHP as the scripting language. Like other dynamic server pages such as ASP and JSP, PHP scripts are processed by the web server. These PHP scripts are responsible for the application logic of the system. The database management tier of the application uses MySQL as the DBMS, which controls the data logic of CrsMgr. When the user of the Course Manager system requests a page, the web browser communicates with the Apache web server through the HTTP protocol. The web server runs PHP scripts based on user requirements and returns processing results in a plain HTML page to the web browser. If the request requires data from the database, the PHP scripts will interact with the backend MySQL DBMS.

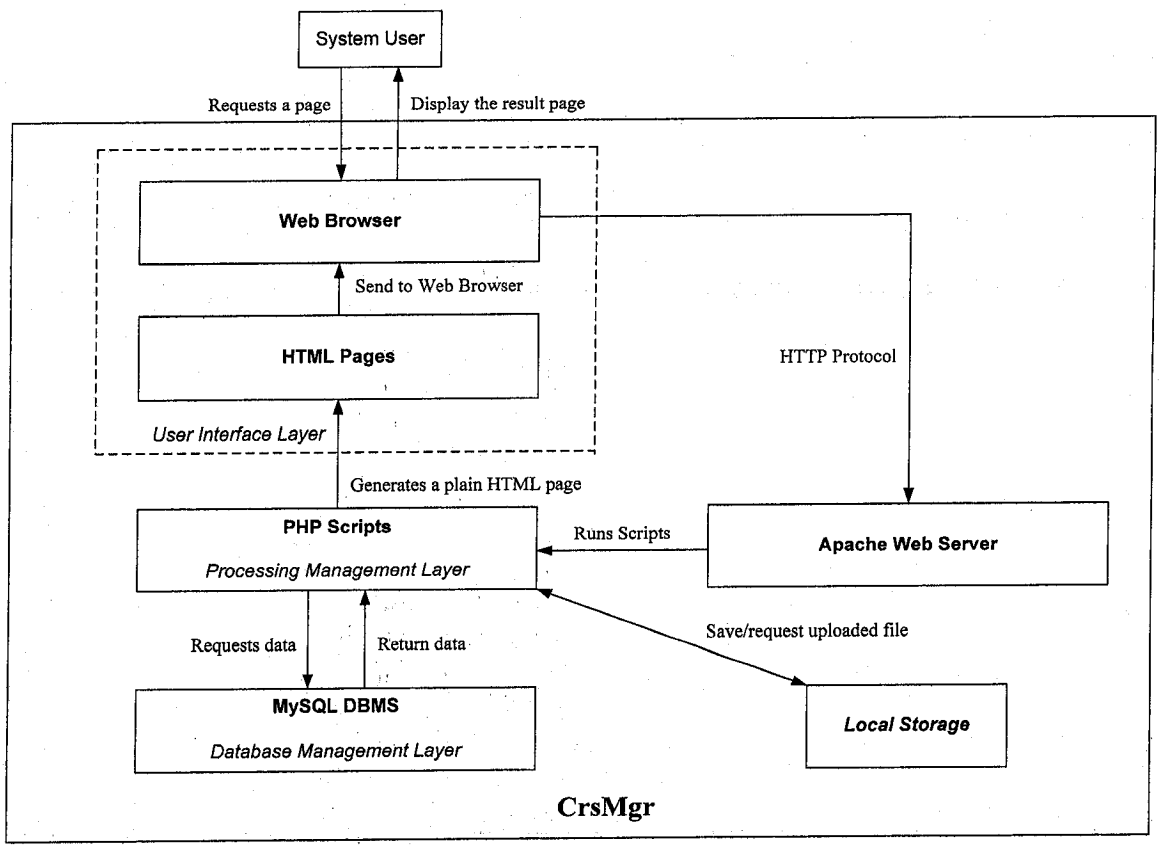


Figure 3.1 Architecture of CrsMgr

3.2 Why Use LAMP Platform?

CrsMgr is run on a well-known open-source web platform, the LAMP platform (Linux + Apache + MySQL + PHP/Perl) [15]. Let's take a look at the advantage of using each of the components of the LAMP platform.

We use Linux as the operating system for CrsMgr. Linux is a free UNIX-type operating system originally created by Linus Torvalds, a young student at the University of Helsinki in Finland. Apart from the fact that Linux is freely distributed; its functionality, adaptability, and robustness have made it the main alternative for proprietary UNIX and Microsoft operating systems [16].

Apache is a famous free and open source web server that runs well under both Windows and UNIX-like operating systems. Since April 1996 Apache has been the most popular HTTP server on the World Wide Web; as of August 2007 Apache served about 50% of all websites. Its flexibility, power, and price make it a popular choice [17, 18].

MySQL is a multithreaded, multi-user, open source relational database system (RDBMS). It is a Structured Query Language server designed for heavy loads and processing of complex queries [19-21]. It is a small, compact database server ideal for small – and not so small – applications. In addition to supporting standard SQL (ANSI), it compiles on a number of platforms and has multithreading abilities on UNIX servers, which makes for great performance. MySQL can also be run as a service on Windows NT and as a normal process in Windows 95/98 machines. MySQL also provides multiple APIs for C, C++, Java, Perl, PHP and Python. MySQL server handles concurrency, provides fast access, and guarantees that only authorized users can obtain access. Its privilege and password

system is very flexible and secure, and allows host-based verification. Passwords are secure because all password traffic is encrypted when connected with a server.

PHP (PHP: Hypertext Preprocessor) is a server-side, cross-platform, and HTML embedded scripting language used to create dynamic web pages [22-24]. PHP was created in 1994 by Rasmus Lerdorf and was originally called Personal Home Page Tools (PHP Tools). PHP can perform the same tasks as a CGI program can do and is compatible with many different kinds of databases such as Informix, Oracle, Sybase, Solid, MySQL, PostgreSQL, and ODBC. It has been a popular open-source alternative to Microsoft's ASP.

Based on the above discussions, using LAMP platform for CrsMgr is certainly an excellent choice.

3.3 CrsMgr User Classes

As we mentioned in chapter 1, a system user could be a professor or a student based on the user's identity. In CrsMgr, there are 10 different system access roles, which are divided into two groups of 5 roles each; they are the administrative roles and the student roles. The group of administrative roles includes System Administrator, Department Administrator, Course Coordinator, Course Instructor, and Thesis Supervisor. The group of student roles includes Course Student, Course Marker, Course Tutor, Lab Tutor, and Graduate Student. The administrative roles are assigned to the professor users and the student roles are assigned to the student users. A system user could have multiple system access roles. For instance, a professor user could be a Course Instructor and a Thesis Supervisor at the same time. The system provides different functionalities for the users

with different access roles. We will briefly highlight the common functionalities for each access role here; the detail descriptions for these features are given in Chapter 4.

3.3.1 System Administrator

A system administrator is the most privileged user of CrsMgr and is able to perform the following tasks: create/update/remove departments; assign/update/remove department administrators; create/update/remove users; enable/disable user access privileges; search existing users; update predefined system emails; create/update/remove secrete questions; create/update/remove demo quizzes; change the password for any user; change email address. Furthermore, a system administrator has the access privileges for lower level administrative roles and could assume any of these roles.

3.3.2 Department Administrator

A department administrator is able to perform the following tasks: create/update/remove courses; create/update/remove course sessions/sections; assign/update/remove course coordinators/course instructors; update the information of professors; enable/disable the access privileges of the professors; insert/remove students to/from the courses; update the information of course students; assign/remove graduate students to thesis supervisors; update information of the graduate students; create and maintain question banks for the courses offered in the department; change the passwords for the professors, the course students and the graduate students; change his own password and email address. Furthermore, a department administrator has the access privileges for lower level roles including those of Course Coordinator, Course Instructor, and Thesis Supervisor.

3.3.3 Course Coordinator

A course coordinator is able to perform the following tasks: update/remove course sections; assign/update/remove course instructors; view the instructor/course student list for all course sections; create/update/ remove common course material; send teaching emails to predefined user groups; maintain the question bank for the course; change her own password and email address.

3.3.4 Course Instructor

A course instructor is able to perform the following tasks: view the contact information for the course session; insert/remove/update course students; create/update/remove course groups; setup peer reviews for group works; create/update/remove course material; setup online assessments; download and mark the student submissions; insert/remove course teaching assistants; create/update/remove tutorial/lab time slots; create/update/remove meeting time slots for different purposes; assign/cancel meeting time slots reservations; send teaching emails to predefined user groups; access the question bank for the course; change the password for the course students; change her own password/email address.

3.3.5 Thesis Supervisor

A thesis supervisor is able to perform the following tasks: add/update/remove graduate students; create/update/remove thesis projects; assign/remove graduate students to/from the thesis projects; upload/update/remove project files; change his own password/email address.

3.3.6 Course Student

A course student is able to perform the following tasks: view the course contact information for the instructor and teaching assistants; access the course material created by the instructor or the coordinator; vote for tutorial and lab time slots when it's required by the instructor; join a course group and vote for the group leader; participate in the peer review(s) for the group works; reserve meeting time slots for different purposes; upload online submissions for assignments/projects; take online assessments; access course grades and feedbacks given by the instructor or makers; change his own password/email address.

3.3.7 Course Marker

A course marker is a teaching assistant; he is able to perform the following tasks: view the course contact information for the instructor and teaching assistants; access the course student list; view the information of course groups; access the peer review details; access the course materials; view the tutorial and lab time slots list; download and mark the student submissions; change her own password/email address.

3.3.8 Course Tutor

A course marker is a teaching assistant; he is able to perform the following tasks: view the course contact information for the instructor and teaching assistants; access the course student list; access the course materials; view the tutorial and lab time slots list; change her own password/email address.

3.3.9 Lab Tutor

A lab tutor is a teaching assistant; he is able to perform the following tasks: view the course contact information for the instructor and teaching assistants; access the course student list; view the details of course groups; access the course materials; view the tutorial and lab time slots list; create/update/remove meeting time slots; assign/cancel meeting time slot reservations; change his own password/email address.

3.3.10 Graduate Student

A graduate student is able to perform the following tasks: view the contact information of the supervisor(s); access the details of a thesis project that he has attended; upload/download project files; change his own password/email address.

3.4 Important Features of CrsMgr

Before discussing the design model of CrsMgr, we would like to highlight briefly several important system features in this section, and more details will be discussed in Chapter 4.

3.4.1 Password Retrieval

On the login page of CrsMgr (see Figure 3.2), a "Forgot Password?" link is provided for those users who have forgotten their passwords and wish to retrieve them. There are several steps for password retrieval. First, the personal information including the user identity (professor or student), ID (professor ID or student ID), and the student name is verified by the system (see Figure 3.3). Secondly, if a matched user is found based on the submitted user information, the user is requested to answer three secret questions for

validation purpose (see Figure 3.4). The three secret questions and the answers are created by the user during his first login.

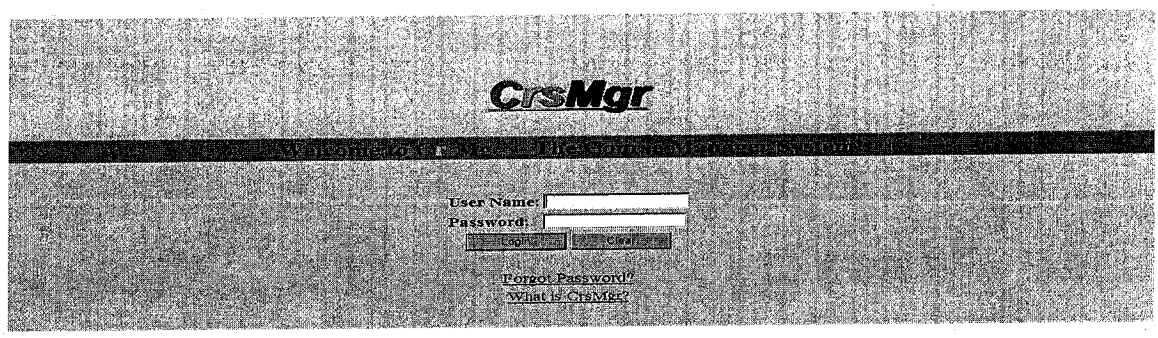


Figure 3.2 System Login Page

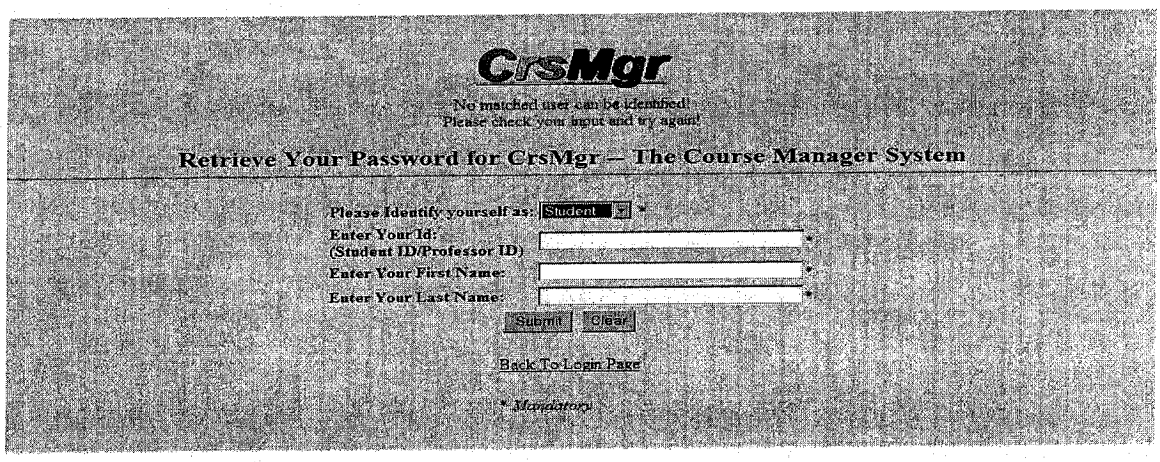


Figure 3.3 Password Retrieval -- Verify Personal Information

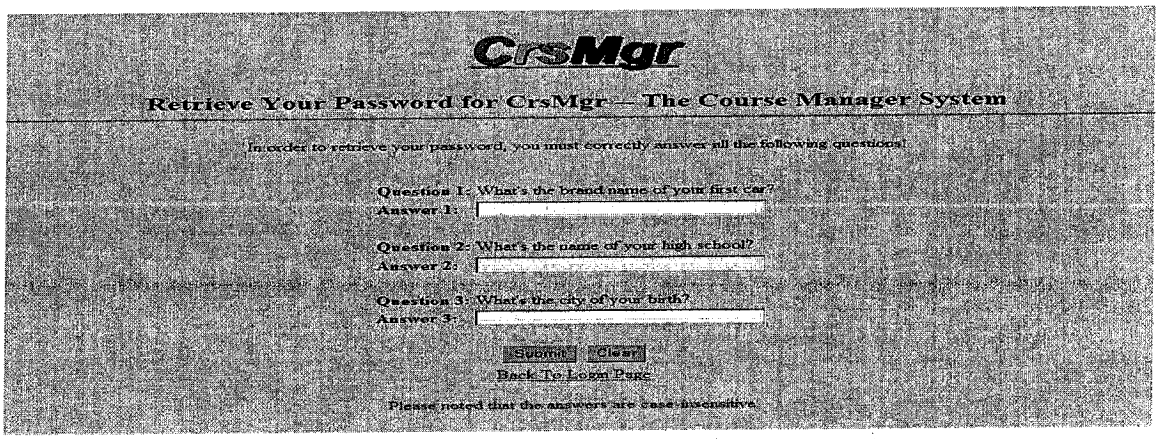


Figure 3.4 Password Retrieval -- Answer Secret Questions

If the user's answers to the secret questions are correct, the user's current password will be sent to his email address which is recorded in CrsMgr. Otherwise, the user may try to answer the questions again or reset his password by following the "reset password" link that is sent to his email address. The "reset password" link contains a "good for 24 hours" temporary token. Figure 3.5 shows the web page when the user clicks on the "reset password" link within 24 hours. In this step, the user is required to enter and submit his user name and the new password. If a matched user with the input user name is found in the system, the password will be reset.

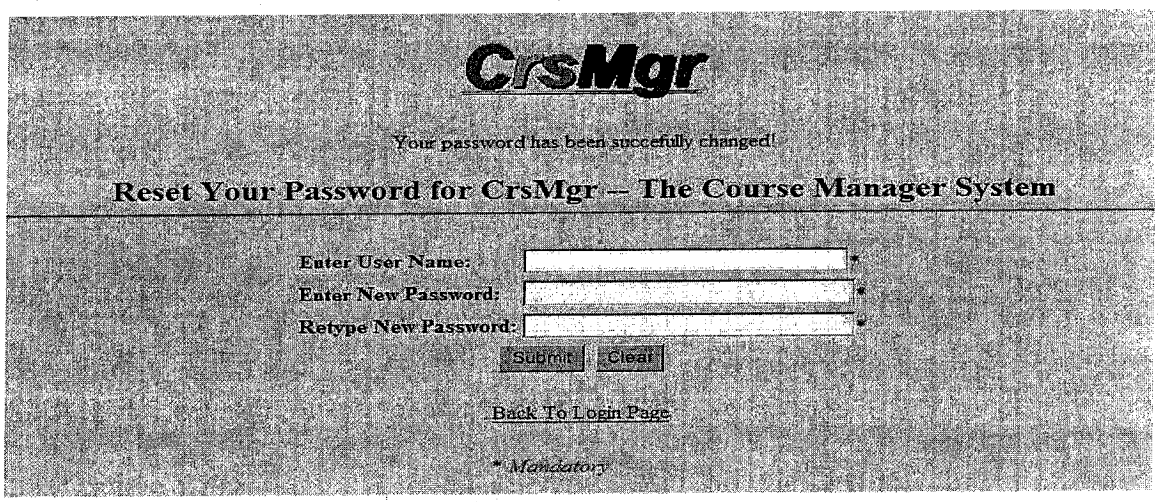


Figure 3.5 Password Retrieval – Reset Password

3.4.2 Online Assessment

In CrsMgr, the course students may take a time limited online assessment during a specific time window set by the instructors. There are two types of online assessment questions: normal question and multiple choice question. A normal question may require a short answer, for which the students could either type their answers in a text box or upload a file for more detail answer. The answer file could be in any format including a

tar-ball. Each question could have multiple versions and include images. Each version of a multiple choice question could have any number of choices and correct answers.

The link for taking an assessment will be available only during the preset time window for that assessment. During an assessment, the students are required to attempt one question at a time; the next question is presented to the student only after the current question is completed. The questions and the answers are shuffled for each student since each question could have multiple versions. The specific version posed to a given student is randomly selected. As a result, the exam pattern is always different for each student; this greatly reduces the possibility of cheating by a group of students.

Once an assessment is started, an assessment window (see Figure 3.6) will be opened to show the first randomly chosen question of the assessment. A timer will start to display the time left for the assessment at the status bar of the assessment window. The timer would continue to run if the assessment window is closed by the user or by accident. Once the timer reaches 0, the assessment will be terminated and the assessment window will be closed. A student could resume his assessment within the assigned time limit after she is disconnected from the system. Each time the student resume her assessment, the question in progress on disconnection will be displayed again.

During an online assessment, the instructor might allow the students to bank one or more questions to try later. To bank an assessment question, click on the "Bank this question" button shown in Figure 3.6. A banked question will be skipped and put in the "Untried" waiting list that is to be chosen for the next question to be shown. To retry a banked question, the student could either select it from the pull down waiting list as the next question or wait for the system to pick it again randomly once all other questions have

been answered. A banked question could be re-banked during a subsequent attempt.

An online assessment could be created by the course instructor or the course coordinator, and the instructors could take one or more "dry run" of the assessment before it is attempted by the students.

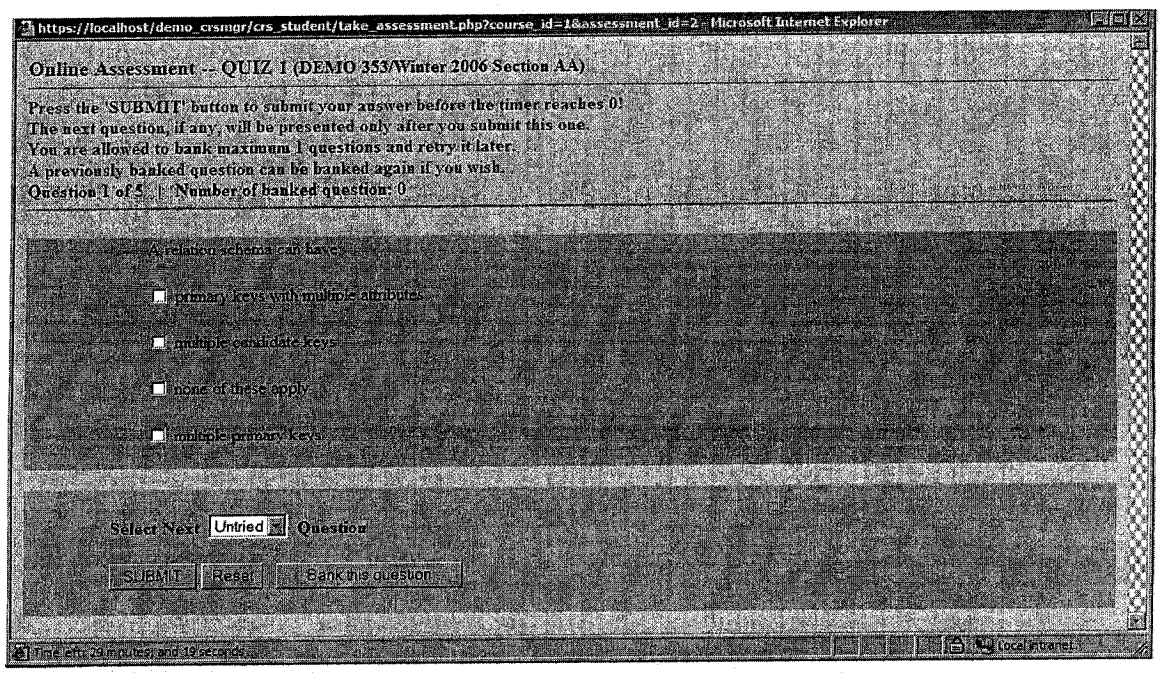


Figure 3.6 Online Assessment

3.4.3 Question Bank

The CrsMgr system provides a question bank for each course to store online assessment questions so that these questions can be reused to generate a new online assessment. The questions in a question bank for a course are grouped by question topics. The Department Administrator is responsible for the creation and maintenance of the question banks for all courses in the department. A Course Coordinator for a course is allowed to make contribution and perform updates to the question bank for the courses he coordinates

during a term. A Course Instructor is only allowed to view the questions in the question bank for the course she teaches and import these questions into the online assessments.

A department administrator or course coordinator has two ways to create questions for a question bank: create one question at a time or insert multiple questions by uploading a XML [25-27] file which contains the data for a number of questions.

3.4.4 Course Group

If a course requires group work, the course instructor will set up a number of empty groups to allow the students enrolled in the course to join one of them. The instructor will set the capacity of the course groups and the deadline to join a group. After the deadline, any student that has not joined a group will be assigned randomly to a group. To join a course group, a course student has two choices: (a) Form a group by uploading a file that contains the student information of the group members; (b) Join one of the existing course groups that are not full and not locked. A course group could be locked by its members so that no other students can join in this group. This allows the students to form smaller groups if it is permitted by the instructor. After the group forming deadline, the students are required to vote for a group leader before another deadline set by the instructor. In a group, a group leader is responsible for coordinating the members to complete their group works during the term. After the deadline for voting the group leaders, the leaders are selected by the system. The selection is based on whether the group members have participated in the vote; a group that has no leader will be assign one leader either randomly or according to the leader votes.

The method used for the group leader vote is a single winner, ranked voting method [28]. In a ranked vote, each voter ranks the candidates in order of preference. In the group

leader vote, each group member is both a voter and a candidate leader. As a voter, a group member is required to ranks all current candidates. The algorithm for the group leader vote is shown as below.

//Algorithm for the group leader vote

//initializations

//The maximum number of runs of comparisons needs to be performed
$N = Number of group members;

//The order of preference from high to low:
{1st choice, 2nd choice, 3rd choice, 4th choice, ..., Nth choice }

Before the deadline for the leader vote, each group member {
    ranks each candidate according to the order of preference;
    no two candidates could be given the same order of preference.
}

After the deadline, the leader is chosen according to the votes as following:

//Current number of outstanding candidates; initially equal to the number of members.
$n = $N;

//The maximum number of votes at the current rank order
//For example, in a group of 4 members,
//the number of 1st order votes obtained by all candidates are: {2, 2, 4, 3},
// then $max_vote=4.
$max_vote=0;

//Current rank order, the vote comparisons start from the 1st rank order
$*k* = 1;

***Steps to be repeated:**
//**********
// Create an array to store the number of votes of the ***k*th rank order** for each candidate

$vote_arr_*k* = { R_kC_1, R_kC_2, R_kC_3, ..., R_kC_j, ..., R_kC_n};

R_k: the *k*th rank order
C_j: the *j*th candiate
R_kC_j : the number of votes of the *k*th rank order for the *j*th candidate
For example: if $R_1C_3 = 4$, then candidate C_3 gets 4 votes of 1st rank order

// Update the counter for the maximum number of votes at current rank order
$max_vote = the maximum value in **$vote_arr_*k***;

```
// Create temporary array to store the IDs of the candidates that have $max_vote at
// the kth rank order

        for($i = 1; $i < $n; $i++){
                if  R_kC_i = $max_vote, add id of C_i -> $temp_id_arr;
        }

//Update the current number of outstanding candidates
        $n = count ($temp_id_arr);

//Check whether comparisons have been done on all level of rank orders

        if ($k < $N ) {
                If($n == 1){ //only one outstanding candidate, no tie happens

                        The candidate in $temp_id_arr is the group leader;
                }
                Else{
                        //reset the counter,
                        //prepare for the comparisons of next level of the rank orders
                        $max_vote=0;

                        //increase the rank order to the next level
                        $k++;

                        Goto the line for *Steps to be repeated
                }
        }

        Else{  //this is the lowest level of the rank orders

                If($n == 1){ //only one outstanding candidate, no tie happens

                        The candidate in $temp_id_arr is the group leader;

                 }
                 else{ //tie still happens when all levels of votes are compared

                        Randomly select one of the tied candidates in $temp_id_arr as
                        the group leader
                 }
        }
//*****************************************************************************************
//End of the steps to be repeated

//End of the algorithm for the group leader vote
```

3.4.5 Peer Review

If group work is required in the course, the instructor may require the members of the group to grade the relative contribution of the other group members. The instructor may choose one of the two types of peer review setting: (1) make a single peer review for all the group works at the end of the term; (2) make one peer review for each group work. Students should participate in the peer review(s) before the deadline(s) set by the instructor. Any one who does not participate in the peer review(s) will get a final zero mark for his group work(s).

On how to calculate the final peer review scores for the students, an instructor has two choices. As the first choice, the average of all evaluation scores given to a student will be used as the final peer review score for this student. As the second choice, the extreme evaluation scores are ignored before calculating the average of the remained scores. To remove the extreme scores, a threshold value (in percentage) is set by the instructor. For each student who is given at least three evaluation scores, if the difference between the maximum score and the minimum score beyond the threshold, one maximum and minimum score will be ignored. The final peer review score for a student will be the average of the remained scores. As is discussed in [29, 30] about the scoring systems used for competition sports, even though the method used in the second choice is not perfect and could not guarantee absolute fairness, it is certainly a better one than the one used in the first choice. The detail algorithm for removing the extreme peer review scores is shown as following.

//Algorithm for removing the extreme peer review scores

Given that an **extreme_threshold** value (in percentage) has been set by the instructor,

Sort the peer review scores for a student in an ascendant order;

```
Count the number of peer review scores;

Let N = number of peer review scores;
    Max_score = the maximum score;
    Min_score = the minimum score;

If (N < 3) {
        No extreme scores will be ignored;
        If (N  == 0) { //no member evaluated this student
                Final score = 100;
        }

        Else    Final score = Average of all scores;
}

Else {
        If ((Max_score – Min_score) / Max_score >= extreme_threshod ){

                One Maximum score and one Minimum score will be ignored;
                Final Score = Average of all remained scores;
        }

        Else    Final score = Average of all scores;
}
```

//End of the algorithm for removing the extreme peer review score

When an instructor requires the students to make one peer review for each group work, she need to decide when to show the peer review scores to the students. One choice is to show the peer review scores right after each peer review deadline; the other choice is to show the scores only when the last peer review is done at the end of the term. During the past experiences, if a student is allowed to view her peer review scores given by the other members after each peer review deadline, she may blackmail her group members before all group works are completed. In order to avoid this "blackmail" threat, the instructor may postpone showing the peer review scores until all peer reviews are completed.

3.5 Database Model

The back-end database of CrsMgr is designed based on the relational model. The relational model was first proposed in 1969 by E. F. Codd, an IBM researcher [31, 32]. In the relational model, data is organized in relations (tables) and the user need not be concerned with the storage structure. One of the main reasons for the introduction of relational model was to increase the productivity of the application programmer [32, 33]. Currently, relational model is the most widely used model in market. Examples of Relational DBMS vendors are: Oracle, IBM, Informix, Microsoft and Sybase.

The E-R designs [32-34] for the system are given in Figure 3.7 to Figure 3.11.

Figure 3.3 shows the following entities as well as the relationships between them: **course_desc**, **course_session**, **course**, **department**, **user**, **role**, **account_email**, **secret_questions**, **password_tokens**, **professor**, **student**, and **course_group**.

Figure 3.4 shows the following entities as well as the relationships between them: **course_desc**, **course_session**, **course**, **teaching_material**, **teaching_email**, and **marked_entity**.

Figure 3.5 shows the following entities as well as the relationships between them:

course, **grade_schma**, **mark_substitution**, **peer_review_setting**, **student**, **course_group**, **ta_time_slot**, **meeting_time_slot**, **marked_entity** and **student_file**.

Figure 3.6 shows the following entities as well as the relationships between them:

course_desc, **course_session**, **course**, **marked_entity**, **assessment**, **assessment_template**, **assessment_question**, **assessment_choice**, **assessment_review**,

question_topic, bank_question_template, bank_question, bank_choice and **user**.

Figure 3.7 shows the following entities as well as the relationships between them:

professor, student, thesis_project, and thesis_project_file.

3.6 Database Tables

We use 61 InnoDB tables to store the information of CrsMgr. The detail structure and descriptions of the tables are given in the Appendix.

Compared to the default MyISAM table type of MySQL, the InnoDB table type provides advantages of excellent support for foreign key constrains and transactions [19].

A foreign key is a field in a relational table that matches the primary key column of another table. We have enforced many foreign key constrains to maintain the referential integrity of the database for CrsMgr. For example, to be able to insert a student row in the ***student*** table, which contains a foreign key ***user_id***, a corresponding user row with the same ***user_id*** must already exists in the ***user*** table.

A database transaction is a logical unit of work that must not be subdivided. In general, a database transaction must be atomic, meaning that it must be either entirely completed or aborted. Ideally, a database system will guarantee the properties of Atomicity, Consistency, Isolation and Durability (ACID) for each transaction [19, 35]. In database product, the ability to handle transactions allows the user to ensure that the integrity of a database is maintained. We need to use many transactions when dealing with course groups in CrsMgr. The pseudo code for a sample transaction to insert a student to a course group is shown below. The constriants are: a student is allowed to join only one

course group; a course group has a predefined capacity and no student can join the group when it's full; a course group could be locked by its current members so that no other students can join the group even though it's still not full.

```
Begin work;
        Lock the course group the student wish to join;
        Check whether this group is locked by its current members;
                If the group is locked, end transaction;
        Check whether the group is full of capacity;
                If the group is full, end transaction;
        Check whether the student is still out of any group;
                If the student is already in a group, end transaction;
        Insert the student into the group;
                If errors occur, rollback;
Commit transaction;
```

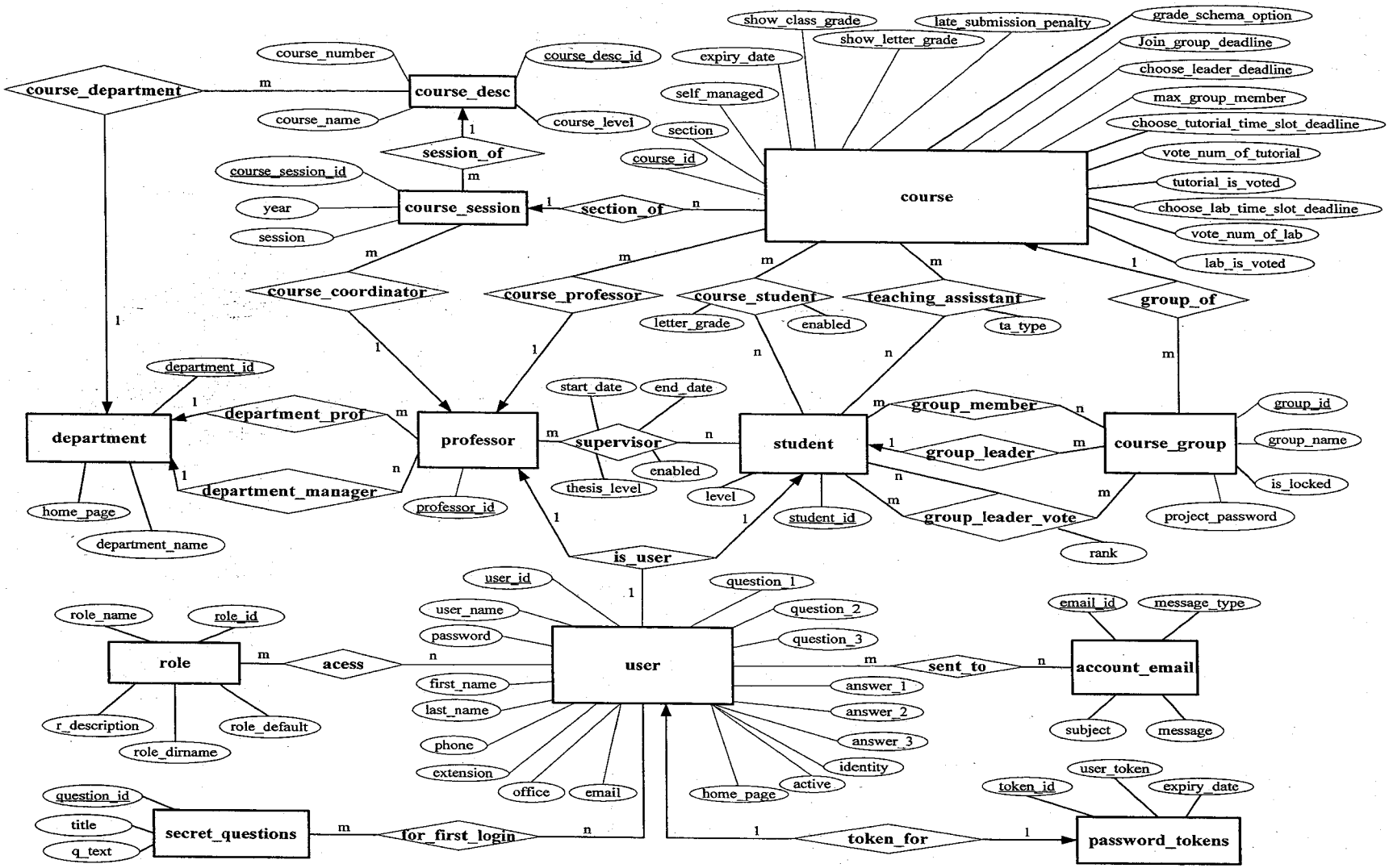


Figure 3.7 E-R Diagram of CrsMgr – Part I

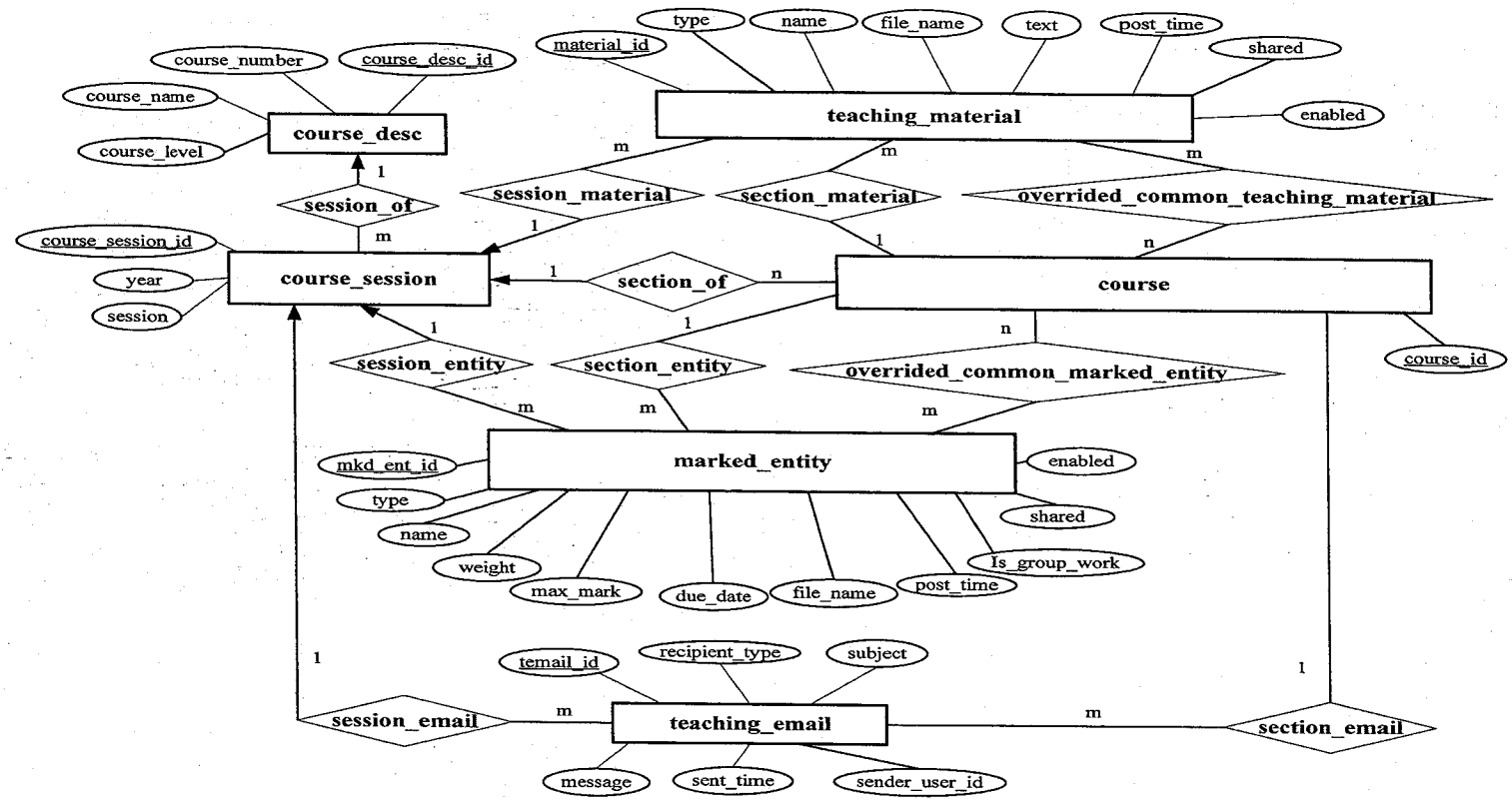


Figure 3.8 E-R Diagram of CrsMgr – Part II

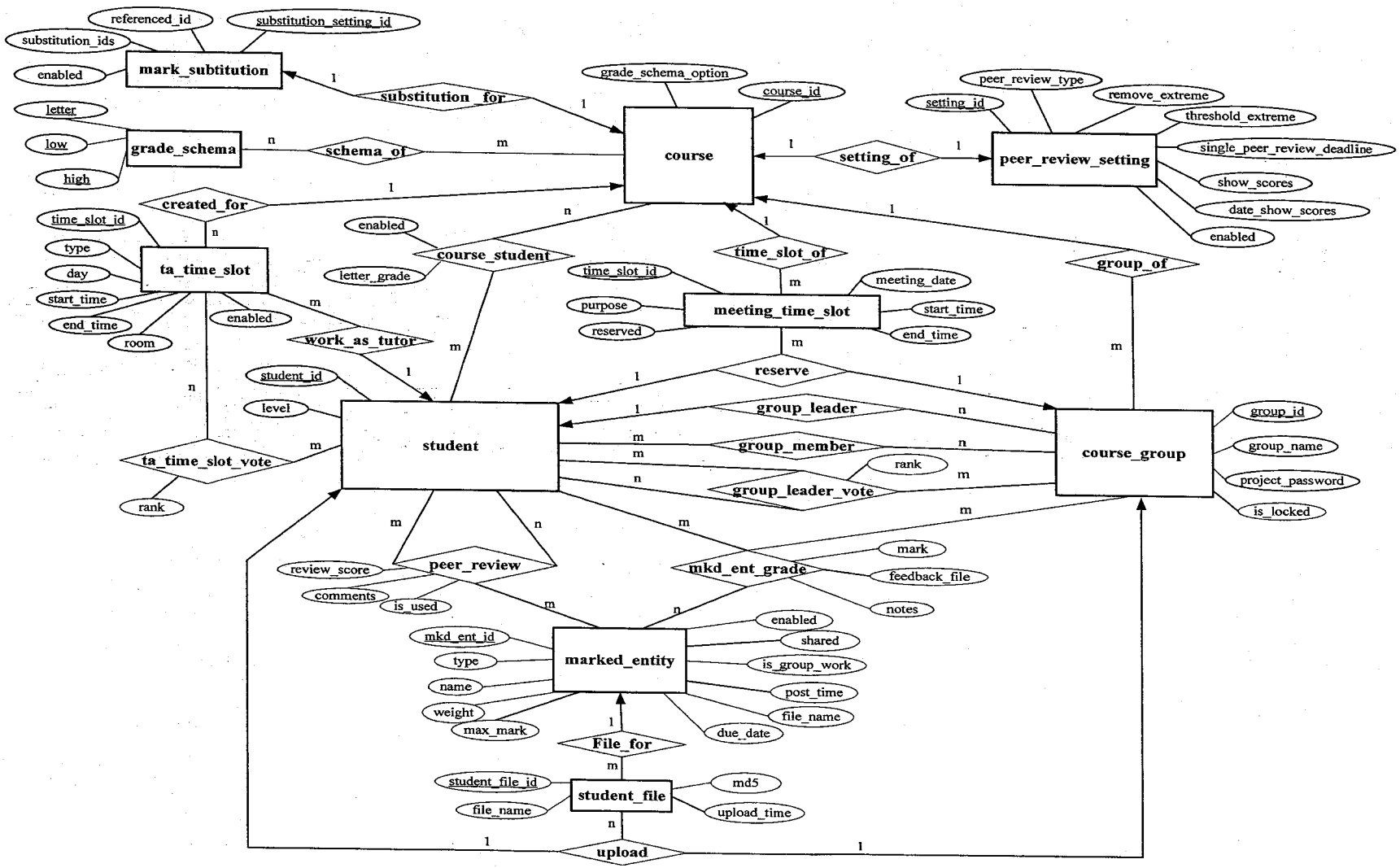


Figure 3.9 E-R Diagram of CrsMgr – Part III

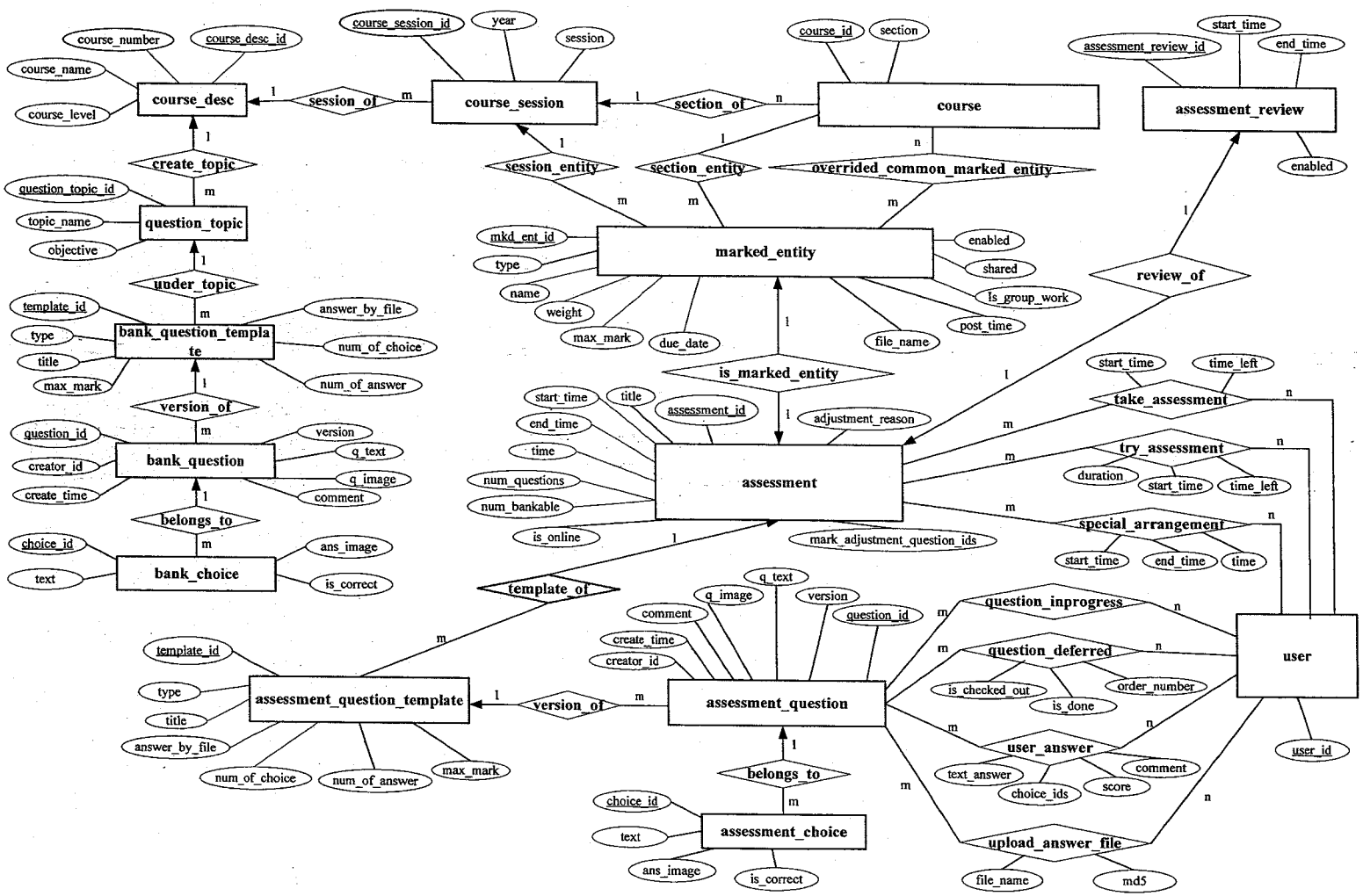


Figure 3.10 E-R Diagram of CrsMgr – Part IV

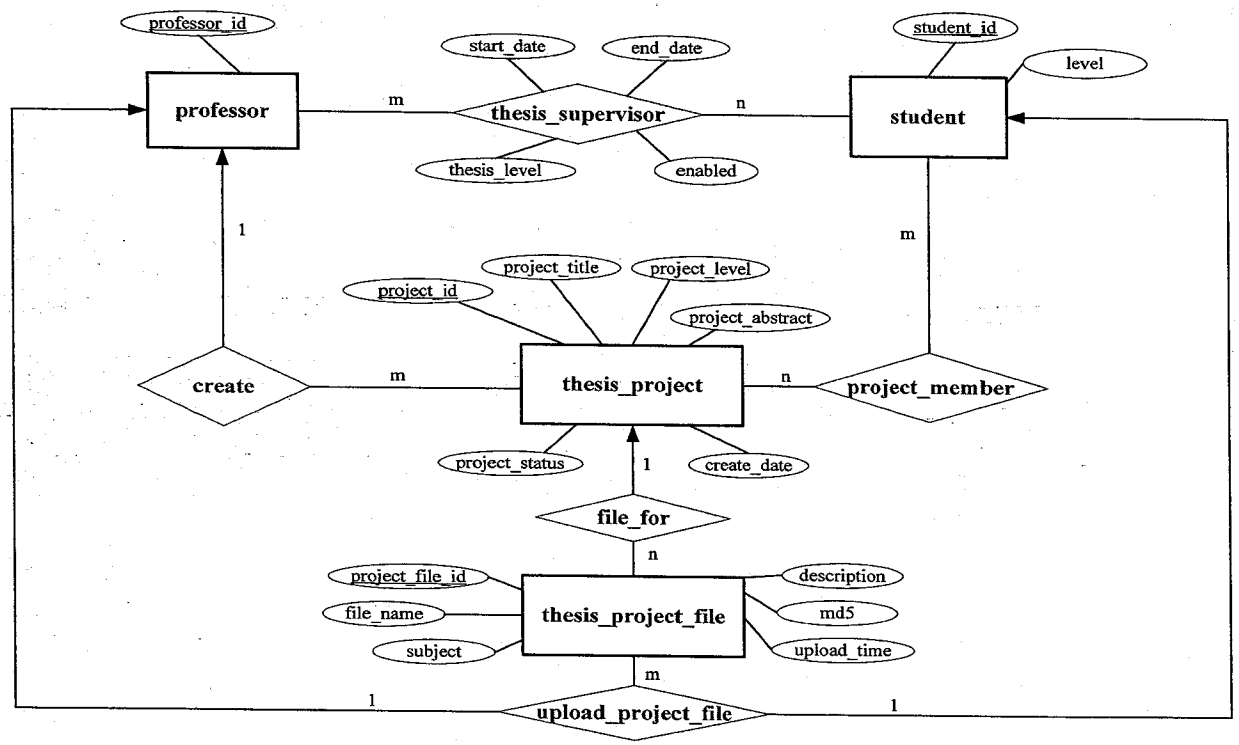


Figure 3.11 E-R Diagram of CrsMgr – Part V

Chapter 4

System Functionalities

This chapter describes the detail functionalities of CrsMgr. Please recall that the user of CrsMgr could be using one of the 10 different system access roles. First, we describe some common functionality for one or more access roles. Then we discuss the functionalities for each access role.

4.1 Common Functionalities

4.1.1 Common Functionalities for All Roles

4.1.1.1 System login

The system login home page (see Figure 4.1) prompts for the input of user name and password. When user input is submitted, the system validates the user name and password with the data stored in the backend database.

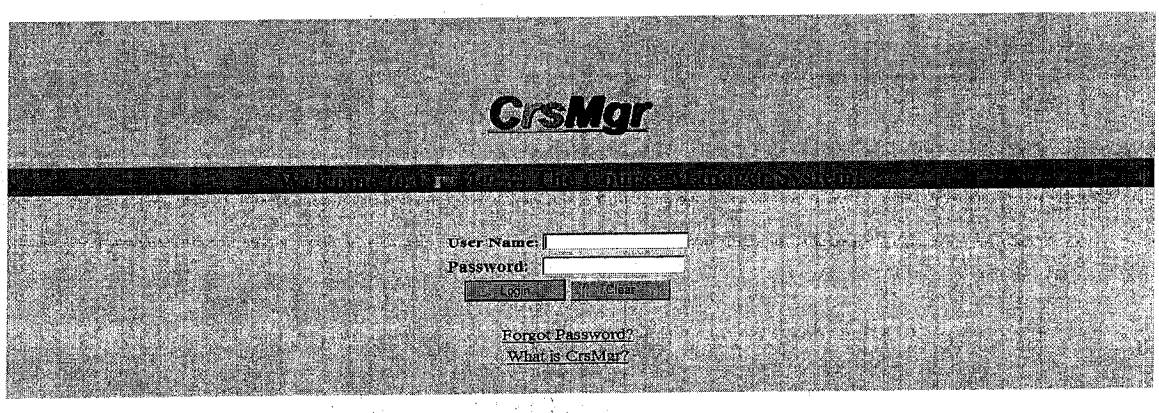


Figure 4.1 System Login Page

4.1.1.2 Password Retrieval

On the login page (see Figure 4.1), a "Forgot Password?" link is provided for those users who have forgotten their passwords and wish to retrieve them. There are several steps for password retrieval and we will go through these steps one by one. First, the personal information including the user identity (professor or student), ID (professor ID or student ID), and the student name is verified by the system (see Figure 4.2). If no matched user based on the submitted information is found in the system, the user is required to correct the information and try again.

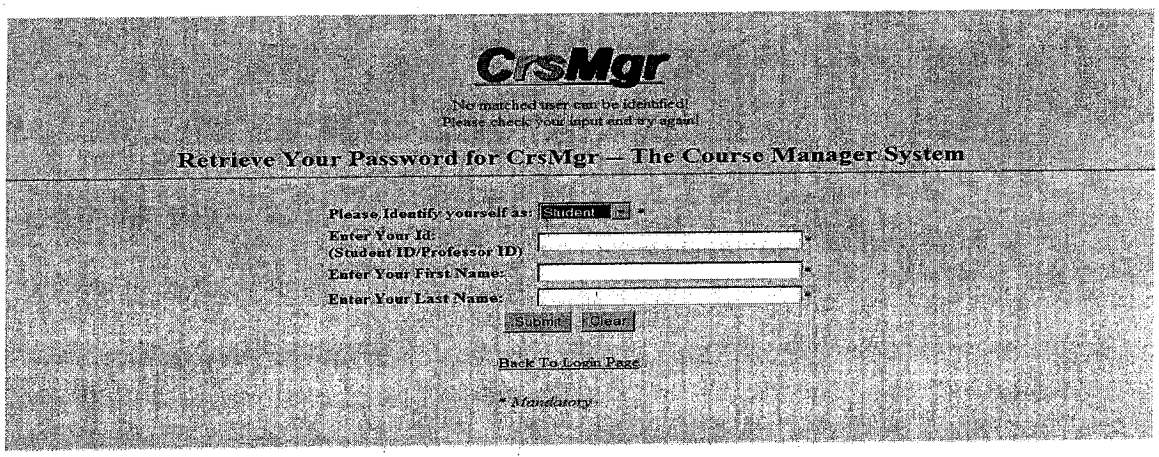


Figure 4.2 Password Retrieval -- Verify Personal Information

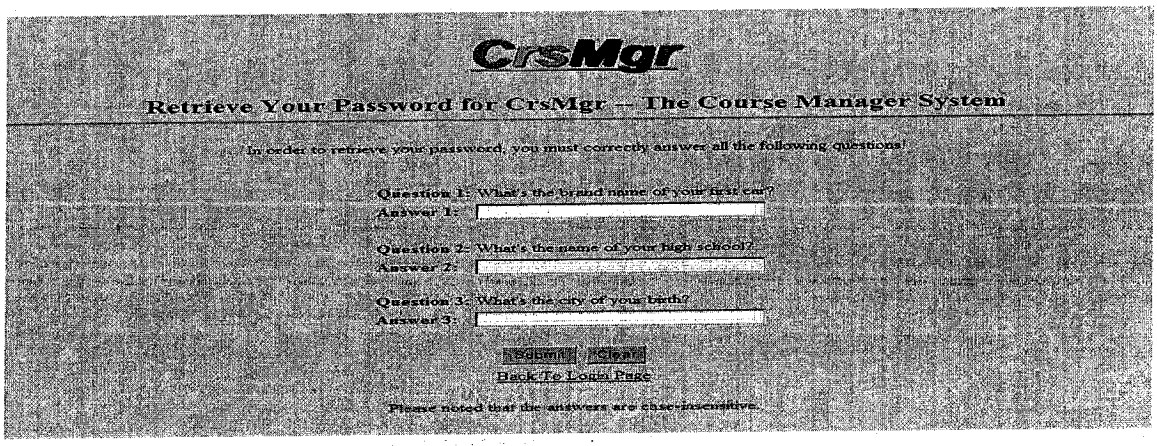


Figure 4.3 Password Retrieval -- Answer Secret Questions

Secondly, if the user enters and submits the personal information correctly, he is requested to answer three secret questions for validation purpose (see Figure 4.3). The three secret questions and the answers are created by the user during his first login. If the user's answers to the secret questions are correct, the user's current password will be sent to his email address which is recorded in CrsMgr (see Figure 4.4).

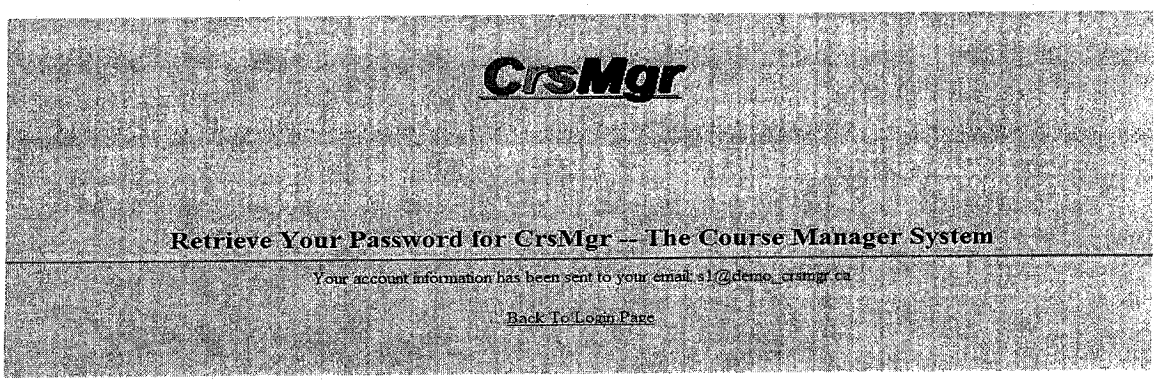


Figure 4.4 Password Retrieval -- Password Emailed to the User

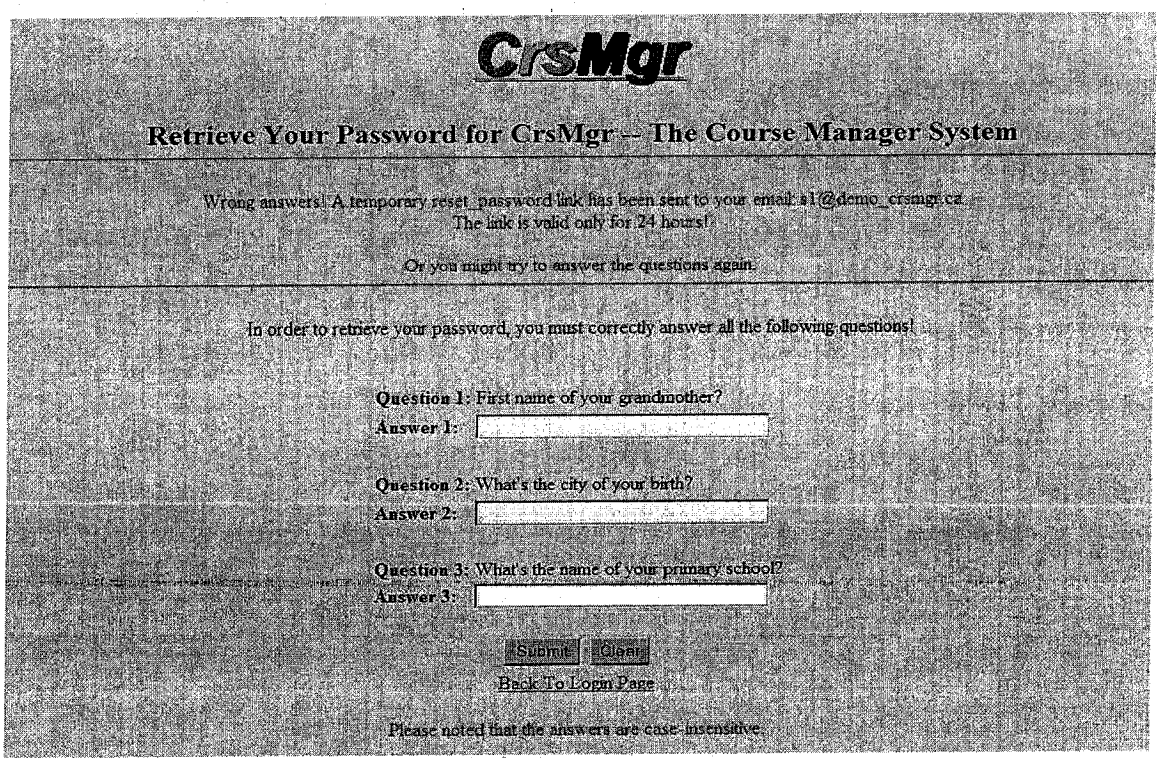


Figure 4.5 Password Retrieval -- Reset Password Link Emailed to the User

Otherwise, the user still has two choices (see Figure 4.5). As the first choice, the user is allowed to answer the questions again. As the second choice, the user could reset his password by following the "reset password" link that is sent to his email address. The "reset password" link contains a "good for 24 hours" temporary token (see Figure 4.6). If a user attempts to reset his password using an expired token, he is suggested to obtain another one by restart the procedure again (see Figure 4.7).

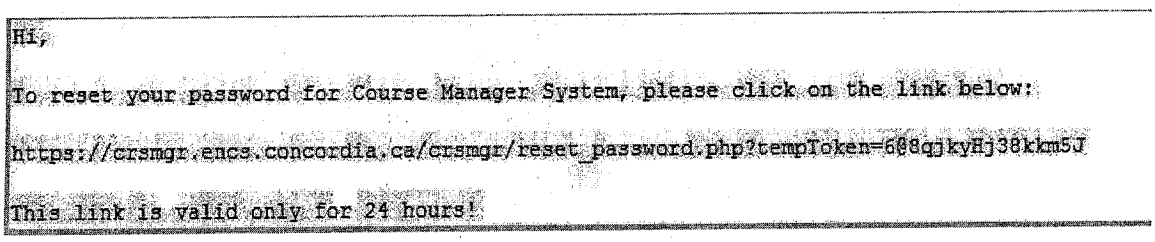


Figure 4.6 Password Retrieval – Email that Contains the Reset Password Link

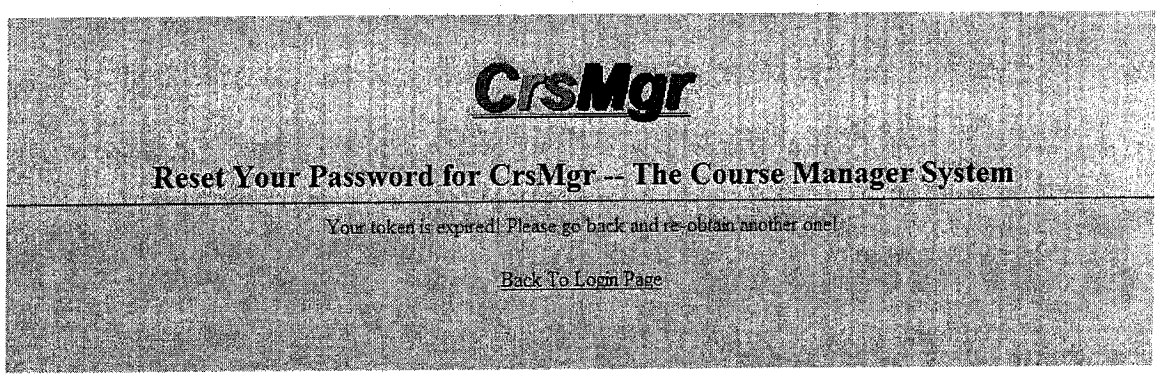


Figure 4.7 Password Retrieval – Token Expired

Figure 4.8 shows the web page when the user clicks on the "reset password" link within 24 hours. In this step, the user is required to enter and submit his user name and the new password. If a matched user with the input user name is found in the system, the password will be reset. The user then can go back to the login page by following the "Back To Login Page" link. Otherwise, the user is suggested to check the input for the user name and try again.

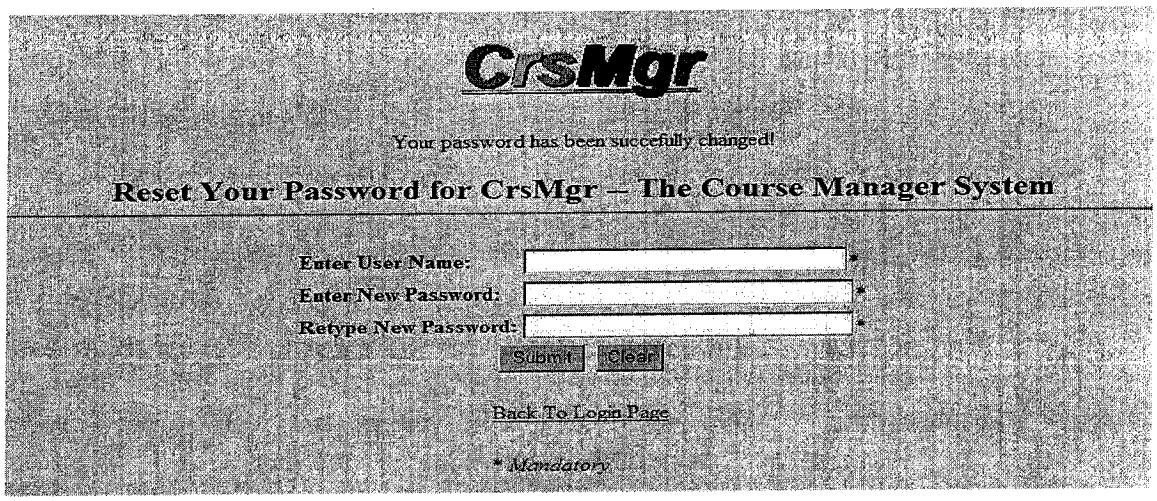


Figure 4.8 Password Retrieval – Reset Password

4.1.1.3 First login

During the first login, a user is required to create three secret questions and answers. These secret questions and answers are used to verify the identity of a user in case he forgets his password. Two options are offered to the users. A user can either pick any three of the system generated questions and fill in the answers or create his own questions (see Figure 4.9).

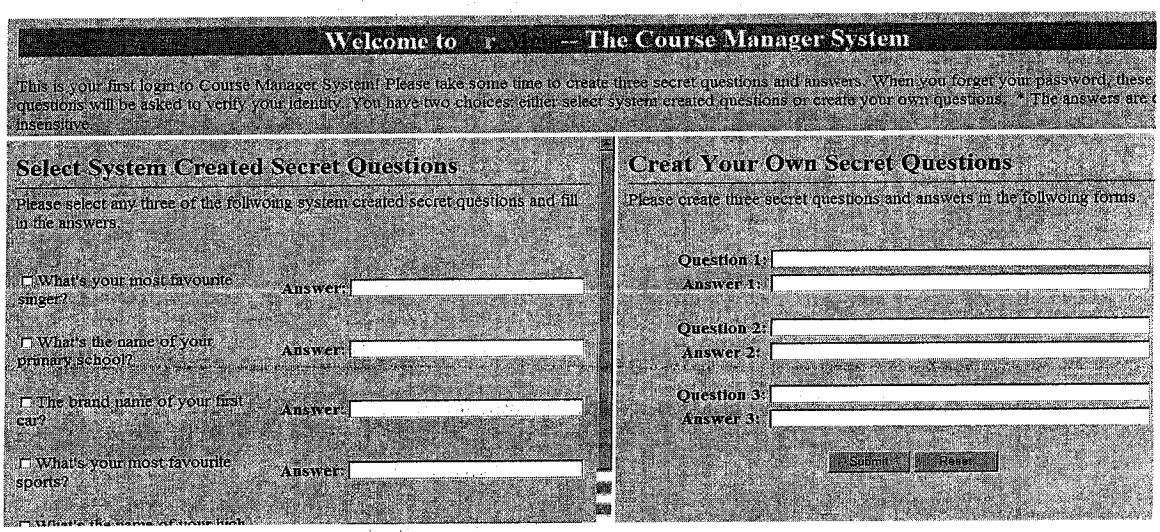


Figure 4.9 Create Secret Questions and Answers

Once a user creates and submits the secret questions and answers, a page is shown to list all the access roles that are available to the user. Figure 4.10 shows the access roles available to the user. The user can freely choose one of his access roles to proceed.

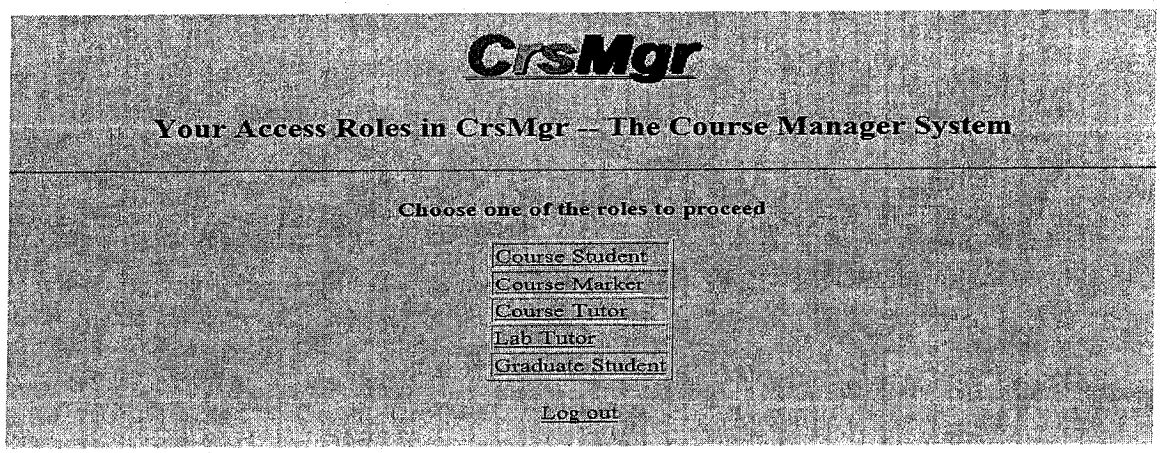


Figure 4.10 User Access Role List

4.1.1.4 Welcome message and quick links

On the top frame of the pages for all access roles, a welcome message which contains the user's full name as well as the current date is displayed. Figure 4.11 shows a page for the System Administrator.

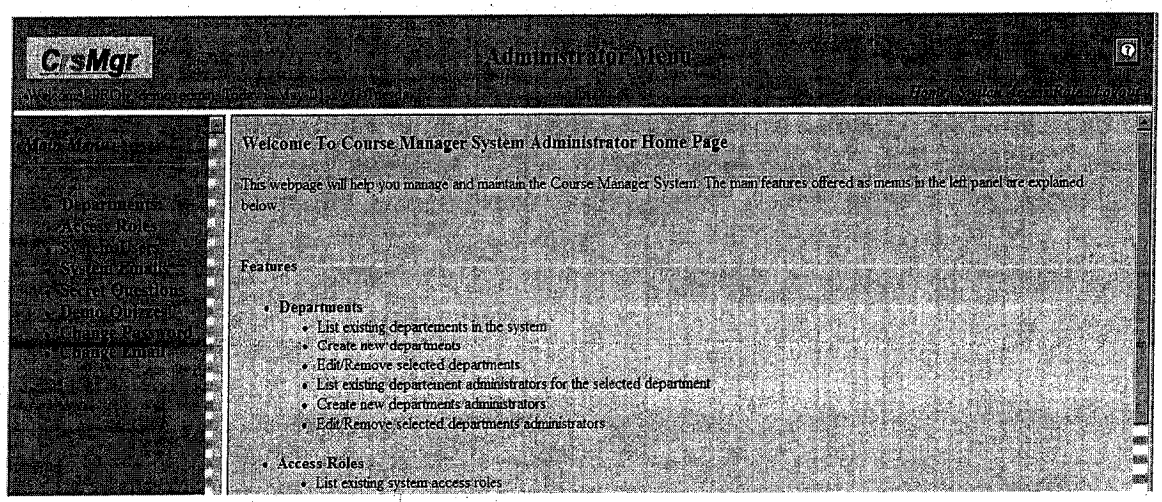


Figure 4.11 Welcome Message and Quick Links

The system checks the date every second and updates the display when the date is changed. Also, three quick links are listed to provide frequently used functionalities as below:

Quick Link	*Functionality*
Home	Show the home page of the specific access role
Switch Access Role	Go to the page that list all the available access roles for the user
Logout	Safely logs the user out

On the top right corner of the top frame, a "Help" button is available to show the help information on the quick links described above.

4.1.1.5 Change password

Each CrsMgr system user is able to change his password. Figure 4.12 shows the page for the password change for a Course Coordinator. However, the System Administrator, the Department Administrator, and the Course Instructor are allowed to change the passwords of other system users; we'll discuss them in detail in the corresponding sections for these access roles.

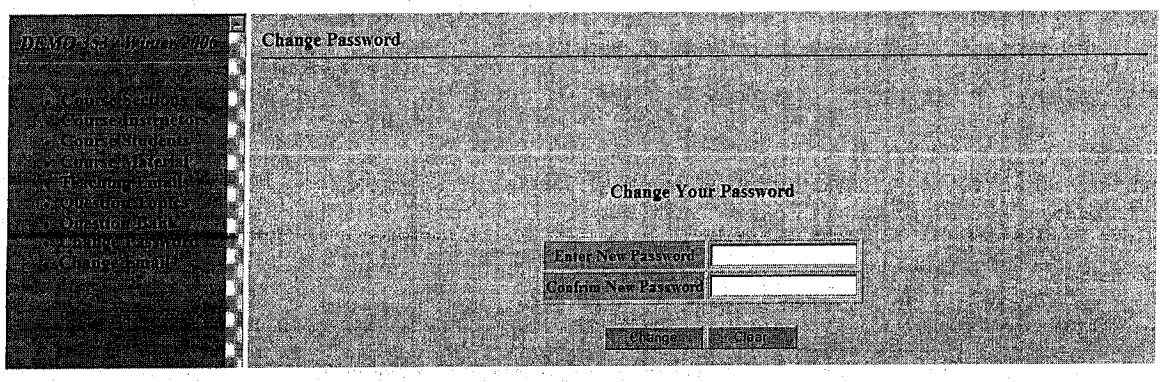


Figure 4.12 Change Password

4.1.1.6 Change email

Each CrsMgr system user can change his email which is recorded in the system. Figure 4.13 shows the page for password change for a System Administrator.

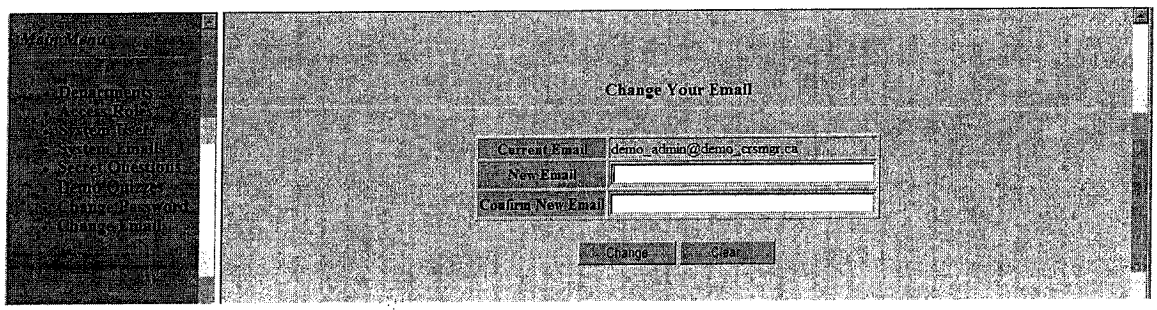


Figure 4.13 Change Email

4.1.2 Question Bank

This is a common feature for the Department Administrator, the Course Coordinator, and the Course Instructor. The CrsMgr system provides a question bank for each course to store online assessment questions so that these assessment questions can be reused by the instructors to generate a new online assessment. There are two types of online assessment questions: normal question and multiple choice question. Each question could have multiple versions and contain images. The questions in a question bank for a course are grouped by question topics. The Department Administrator is responsible for the creation and maintenance of the question banks for all courses in the department. A Course Coordinator for a course is allowed to make contribution and perform updates to the question bank for the course he coordinates during a term. A Course Instructor is only allowed to view the questions in the question bank for the course he teaches and import these questions into the online assessments.

We will describe the detail functionality for the question banks in the following sections and use the pages for the Department Administrator as an example; the pages for the Course Coordinator and the Course Instructor are similar.

Click on the "Question Bank" link (see Figure 4.14) in the left frame of the pages for the Department Administrator; the web page contains the submenus and the overall feature introduction for the "Question Bank" menu is displayed.

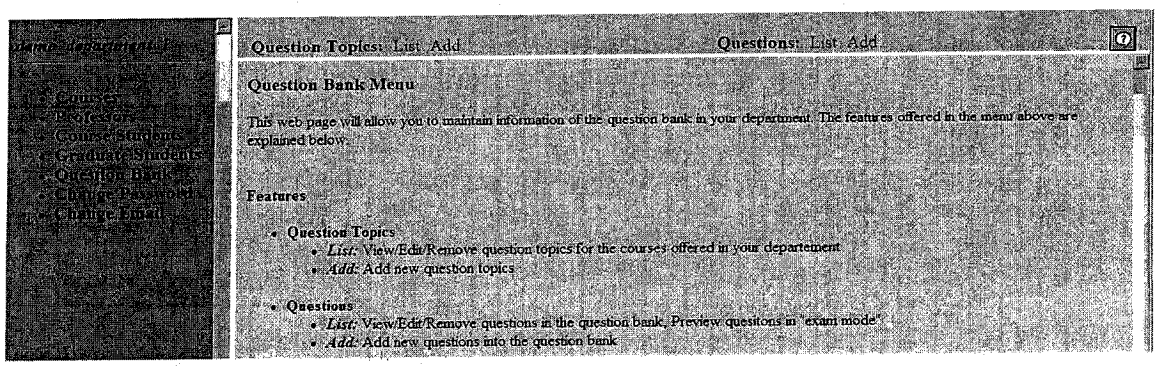


Figure 4.14 Question Bank Menu – Department Administrator

4.1.2.1 Question topic list

Click on the "Question Topics: List" link on the submenu; select a desired course from the pull-down menu to show the list of existing question topics under the course (see Figure 4.15).

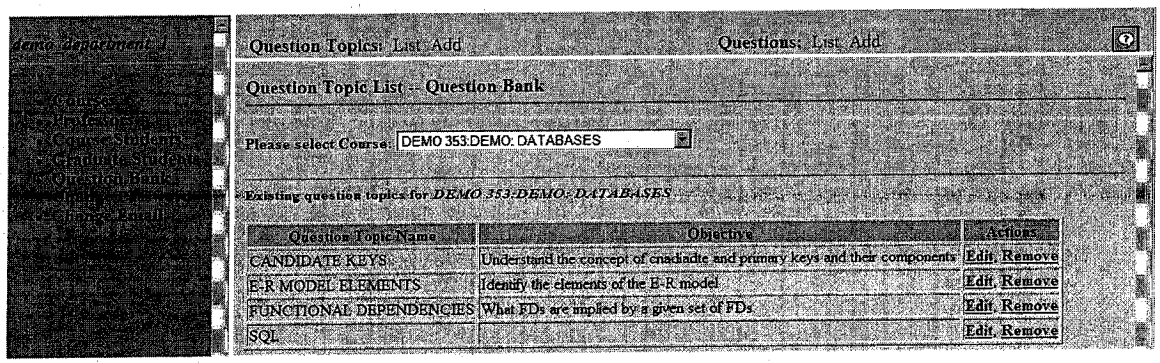


Figure 4.15 Question Topic List

4.1.2.2 Edit/remove question topics

To edit a question topic, click on the "Edit" link (see Figure 4.15) for that topic. To remove a question topic, click on the "Remove" link for that topic. A referenced question topic for which questions are added is not allowed to be deleted.

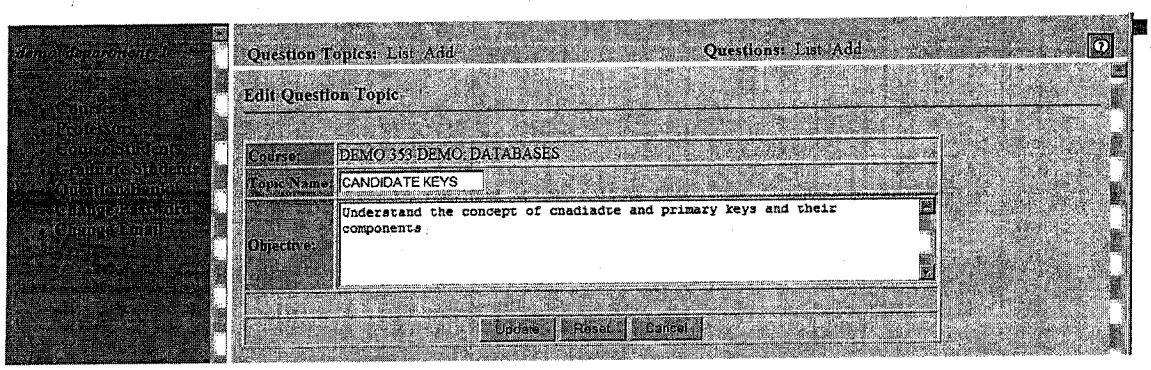


Figure 4.16 Edit Question Topics

4.1.2.3 Create new question topics

To create a new question topic for a course, click on the "Question Topics: Add" link on the top submenu. A question topic must be unique under a given course.

4.1.2.4 List existing questions

Click on the "Question: List" link on the submenu; select a desired course and topic to show the existing questions under the topic (see Figure 4.17). There are two types of questions: normal question and multiple choice question. Each question could have multiple versions and contain images.

4.1.2.5 Bank questions overview

To view all questions in the question banks for the department, click on the "Bank Questions Overview" button (see Figure 4.17). A new window will be opened to list all

the questions ordered by course name and question topic name (see Figure 4.18). The Department Administrator could then print out these questions for offline review.

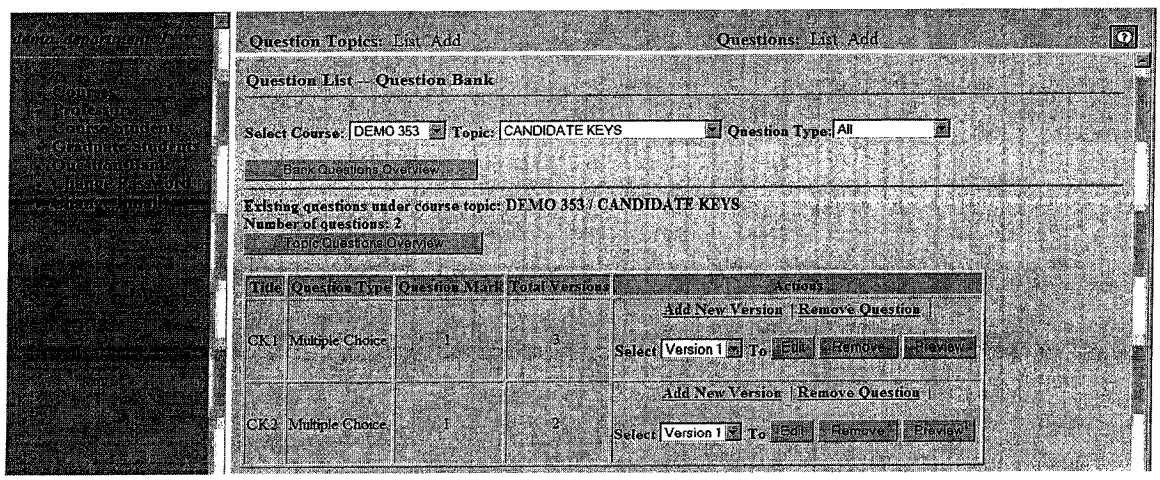


Figure 4.17 Question List – Question Bank

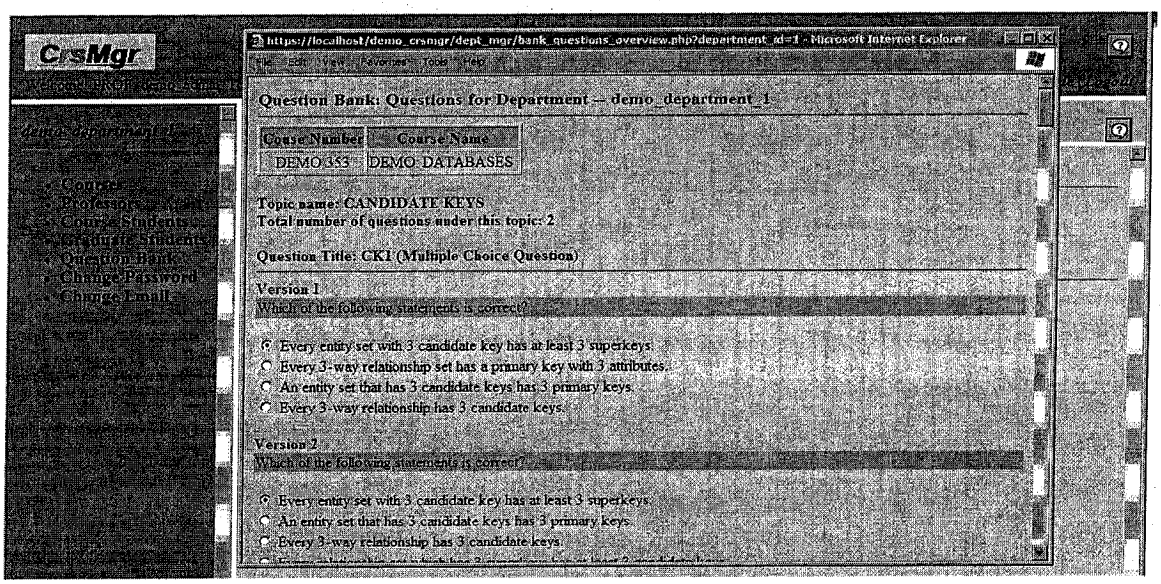


Figure 4.18 Bank Questions Overview

4.1.2.6 Topic questions overview

To view all questions under a certain question topic, select the desired question topic and click on the "Topic Questions Overview" button (see Figure 4.17). A new window will

be opened to list all the questions under the chosen question topic ordered by question title. The Department Administrator could then print out these questions for offline review.

4.1.2.7 Question preview

To preview a question in the "exam mode", click on the "Preview" button (see Figure 4.17) after a version of question is selected. A new window is opened to display the question (see Figure 4.19).

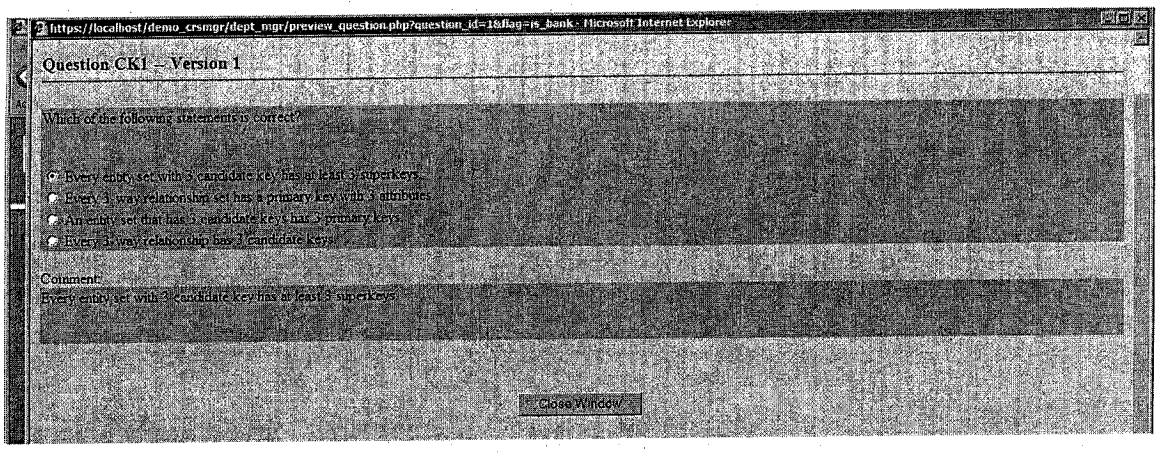


Figure 4.19 Question Preview – Question Bank

4.1.2.8 Edit/remove one version of a question

To update one version of a question, click on the "Edit" button (see Figure 4.17) after the version of question is selected. Figure 4.20 shows the page for editing a version of a question. Similarly, to remove one version of a question, click on the "Remove" button after the version of question is selected.

4.1.2.9 Create new versions for a question

To create a new version for a question, click on the "Add New Version" link (see Figure 4.17) for that question. The version number under same question title must be unique.

Figure 4.21 shows the page for adding a version to a multiple choice question.

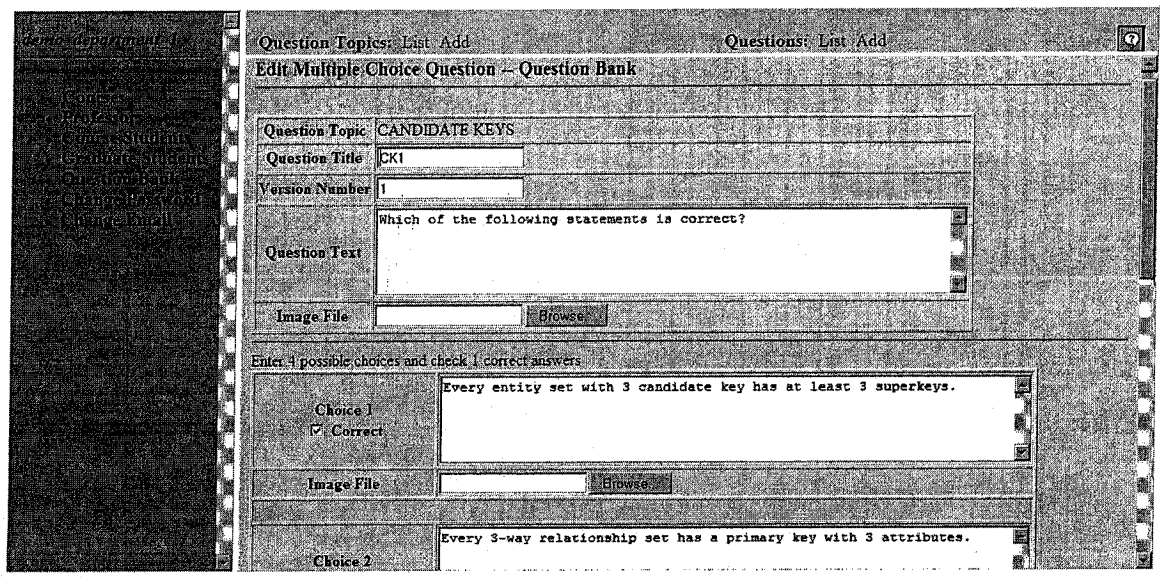


Figure 4.20 Edit Question – Question Bank

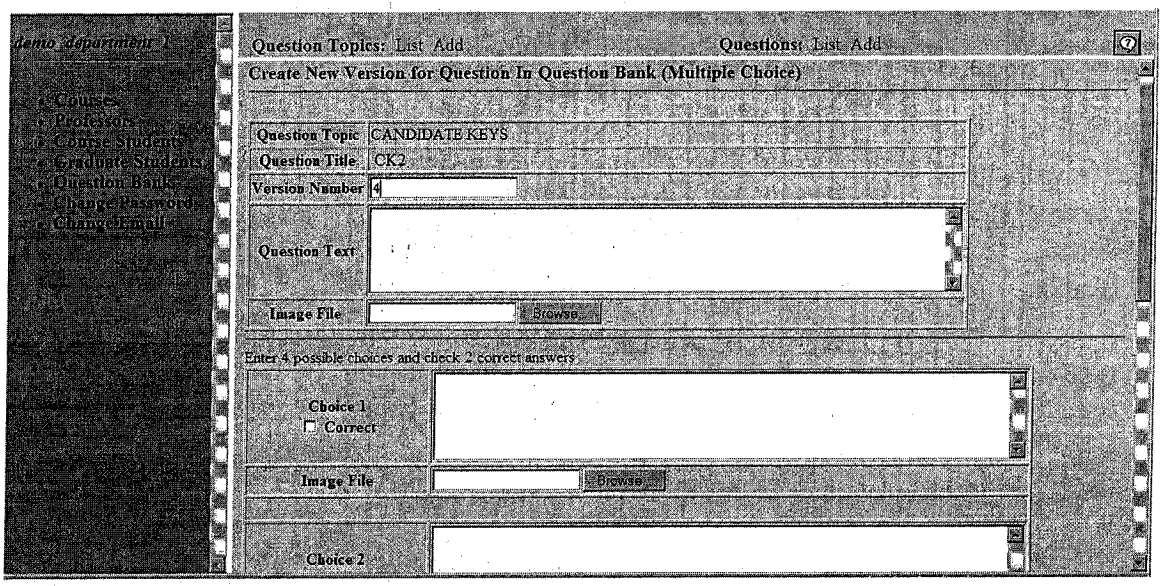


Figure 4.21 Create New Versions for a Question – Question Bank

4.1.2.10 Remove a question

To remove a question from the question bank, click on the "Remove Question" link (see Figure 4.17) for that question. All the versions of the question will be deleted. Figure

4.22 shows the page for removing a question.

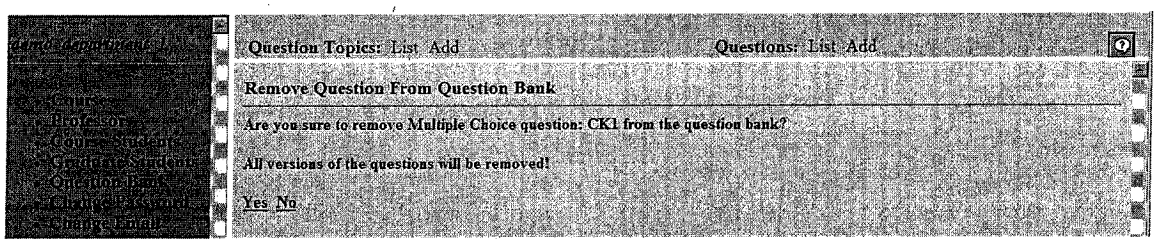


Figure 4.22 Remove Question – Question Bank

4.1.2.11 Add new questions to a question bank

To add new questions to a question bank, click on the "Questions: Add" link. The Department Administrator has two ways to create questions for a question bank: create one question at a time or insert multiple questions by uploading a XML [25-27] file (see Figure 4.23).

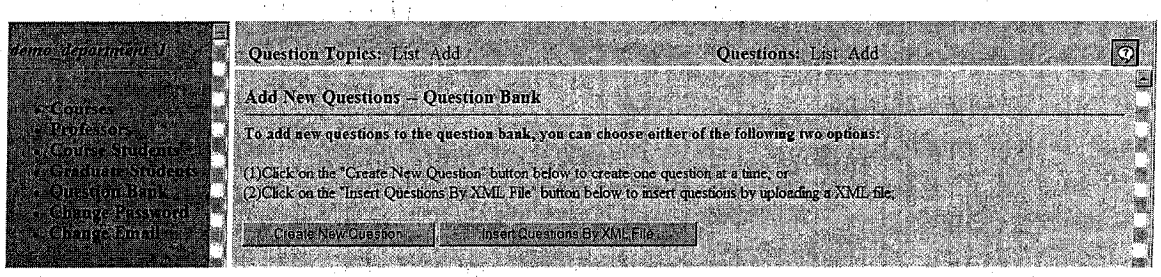


Figure 4.23 Two Ways for Adding New Questions – Question Bank

4.1.2.11.1 Create one question at a time

To create a new question at a time, click on the "Create New Question" button shown in Figure 4.23. There are two steps to create a new question. In step 1, the question topic and question type are selected (see Figure 4.24). For multiple choice questions, any number of choices and correct answer are allowed. In step 2, the question body is input (see Figure 4.25). Images are allowed to be embedded into the question body. The explanations on the question answers can be input in the "comment" text box. For normal

questions, the Department Administrator can specify whether the students submit their answers in text box or upload answers as a file.

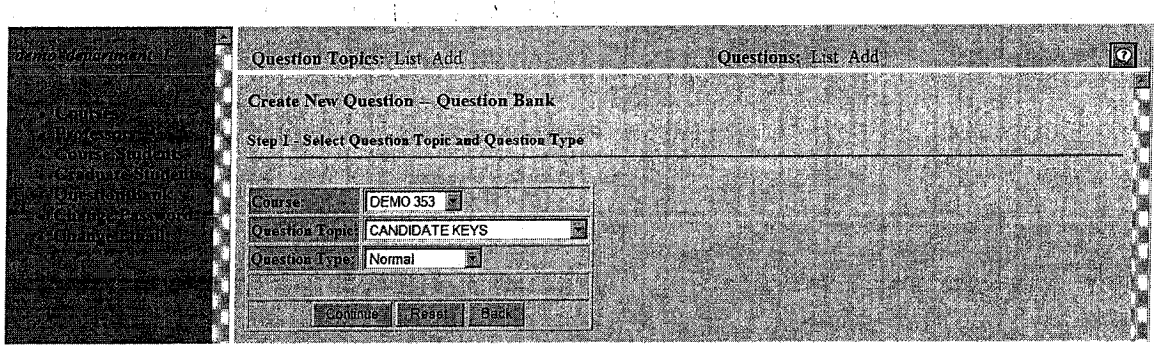


Figure 4.24 Create New Question for Question Bank – Step 1

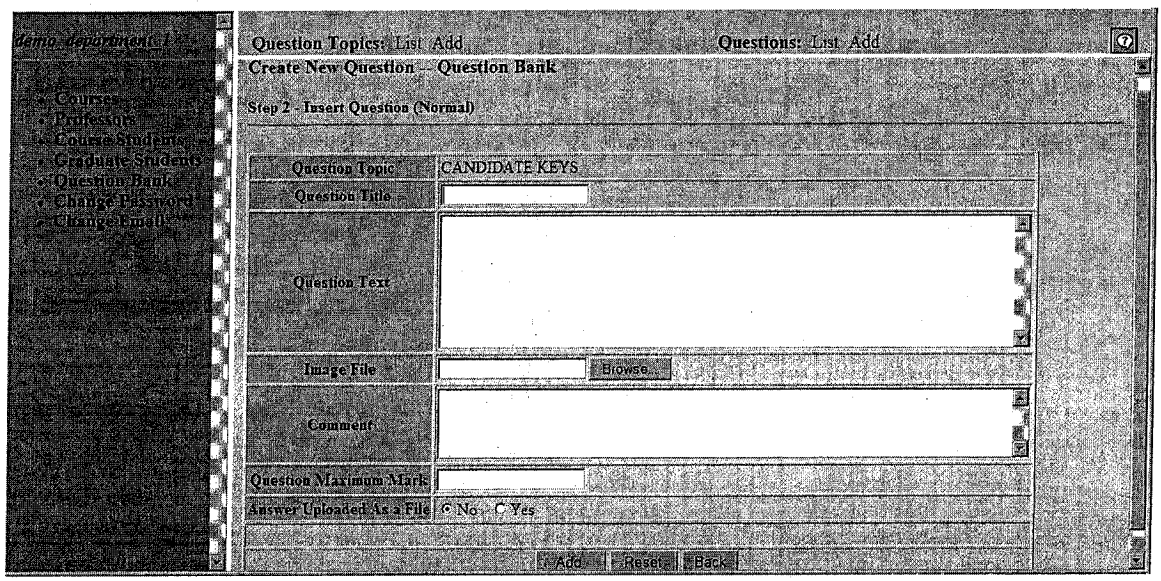


Figure 4.25 Create New Question for Question Bank – Step 2

4.1.2.11.2 Insert questions by uploading a XML file

Click on the "Insert Questions by XML File" button (see Figure 4.23) to insert questions into a question bank by uploading a XML file which contains the data for a number of questions. After the target course is selected (see Figure 4.26), the web interface for uploading XML file is displayed (see Figure 4.27). If the questions contain images, all

image files must be uploaded one by one before the XML file is uploaded. The names of the image files must be unique for a XML file; however, the order of the image files is not important. The same image file could be used for more than one question. The course number specified in the XML file must match the target course. For each question, a title and a topic name must be provided. The target topic must exist in the question bank and the question title must be unique under this topic. For each multiple choice question, the number of choices and the number of correct answers must be specified and the number of versions to be generated is to be provided optionally. If the number of versions to be generated is not specified, the system will generate all possible versions using the given choices. A sample XML file is provided for reference.

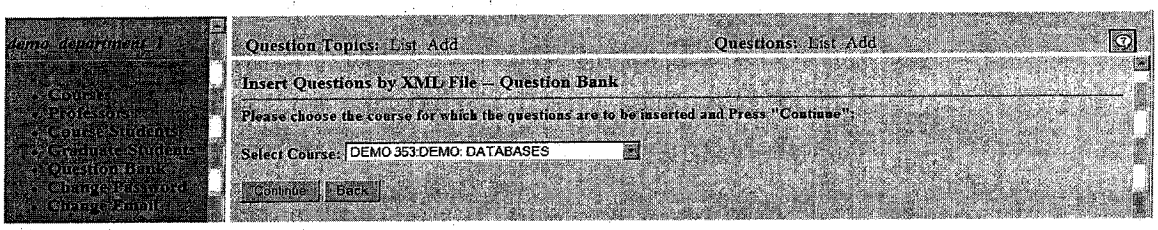


Figure 4.26 Select the Target Course

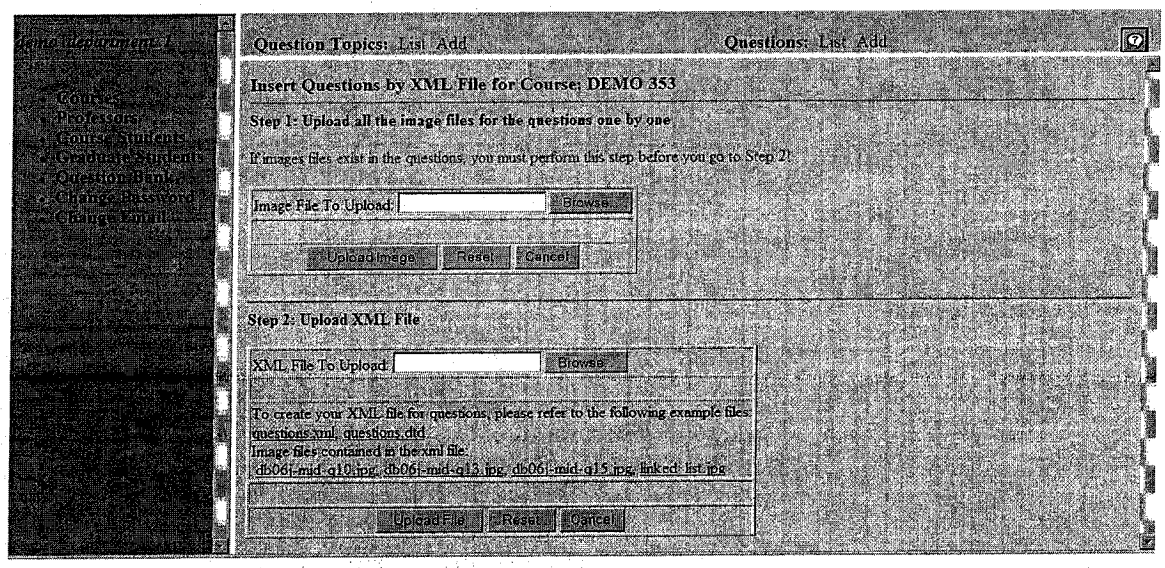


Figure 4.27 Insert Questions by XML File

4.1.3 Course Material

This is a common feature for the Course Coordinator and the Course Instructor. In CrsMgr, course materials are classified into 9 types: assignment, project, quiz, demo quiz, course outline, announcement, lecture notes, solution, and tutorial. Among these types, assignment, project, and quiz are called course marked entities, meaning that these three types of materials are to be used to evaluate the student progress. When a course has multiple sections with different instructors during a term, these sections can be either coordinated or self-managed. The Course Coordinator is required to create and control common course materials for the course during the term. All coordinated sections share common course materials; only the instructors for the self-managed sections are allowed to create their own course marked entities. However, instructors for the coordinated sections are still allowed to create their own course materials that are not course marked entities. The instructors for the self-managed sections could decide to use the common course materials or to create their own. We will describe the detail functionality for the course materials in the following sections and use the pages for the Course Coordinator as an example; the pages for the Course Instructor are similar.

4.1.3.1 Course material list

Click on the "Course Material" link in the left frame of the pages for the Course Coordinator; the common shared course materials are displayed by types (see Figure 4.28). Figure 4.29 shows the course material list for a self-managed section, whose instructor has decided to disable the common assignment "ASG3" and created his/her own "ASG3" for the section. To disable a common course material shared by all coordinated sections, simply click on the "Disable Common Material" link (see Figure

4.29) for that course material. The Course Coordinator or the Course Instructor can choose to view only some selected types of course materials and keep others shown as hidden (see Figure 4.30).

4.1.3.2 Enable / disable course materials

The course materials are seen by the students only when they are set to "Enabled". Click on the "Disable" link (see Figure 4.28) of a course material to suspend the access to that material or click on the "Enable" link of a course material to reactivate the access to a "Disabled" material.

4.1.3.3 Edit / remove course material

To edit or update a course material, click on the "Edit" link (see Figure 4.28) for that course material. Similarly, to remove a course material, click on the "Remove" link for that course material. The deletion of a referenced course marked entity (assignment, project, or quiz) is not allowed. A course marked entity is referenced if there exist student submissions for it. Figure 4.31 shows the page for editing an assignment.

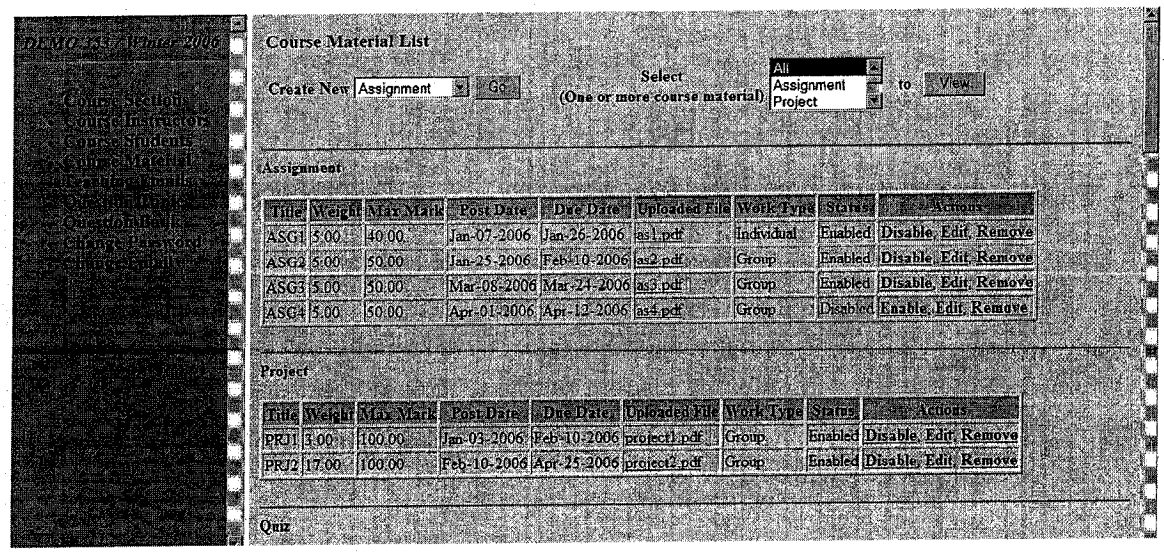


Figure 4.28 Course Material List – Course Coordinator

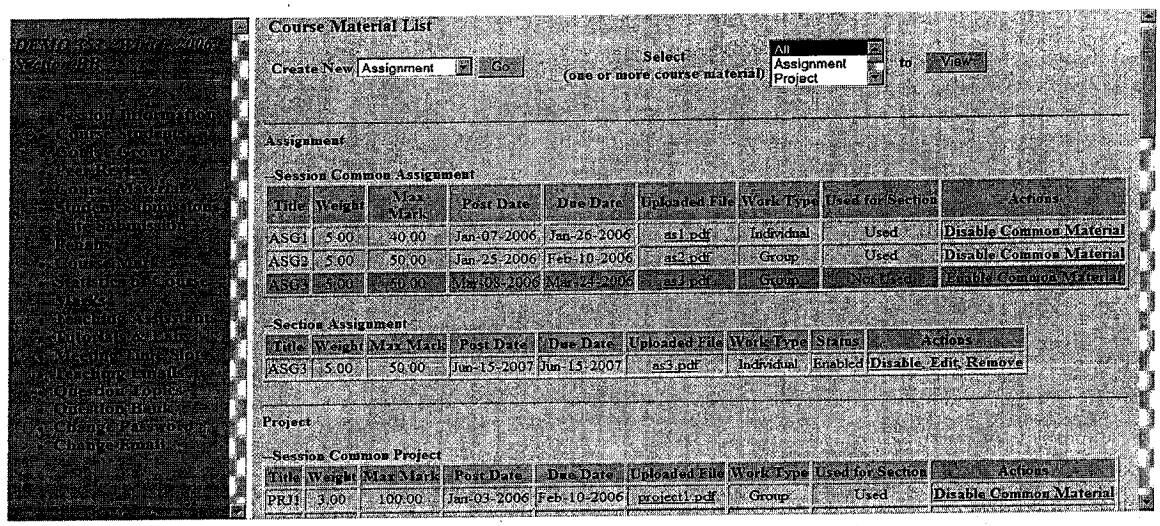


Figure 4.29 Course Material List – Course Instructor (Self-Managed Section)

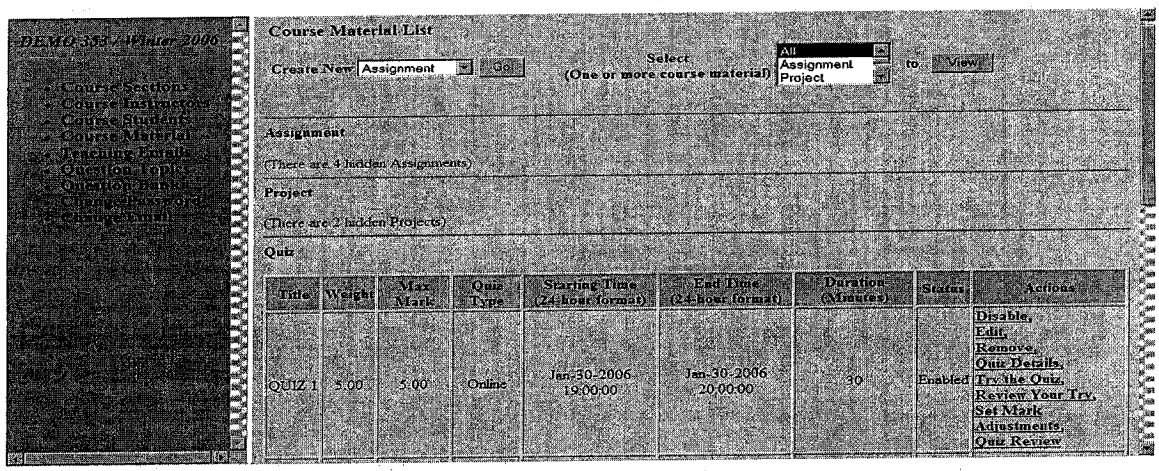


Figure 4.30 Course Material List With Some Hidden Items – Course Coordinator

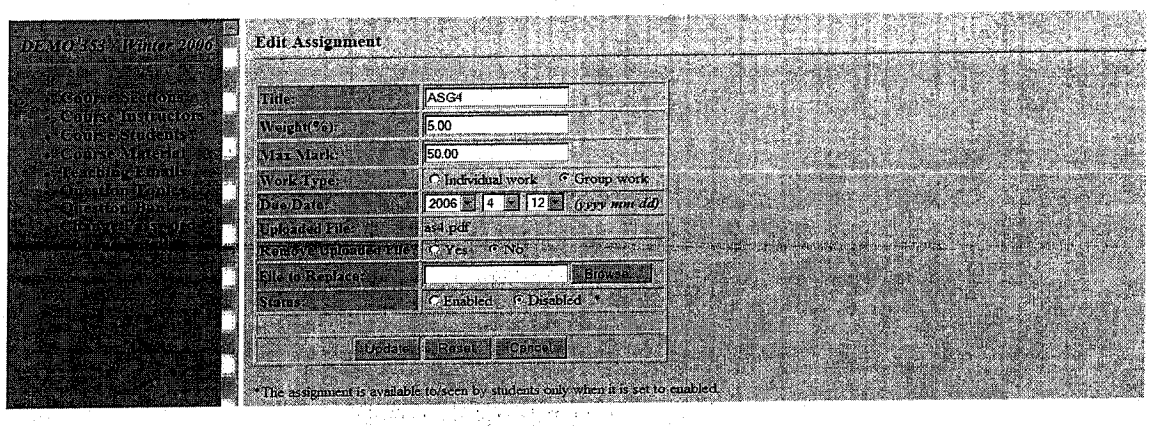


Figure 4.31 Edit Assignment

4.1.3.4 Create new course material

To create a new course material, select the type from the pull-down list and click on the "Go" button (see Figure 4.28). Figure 4.32 shows the page for creating a new quiz.

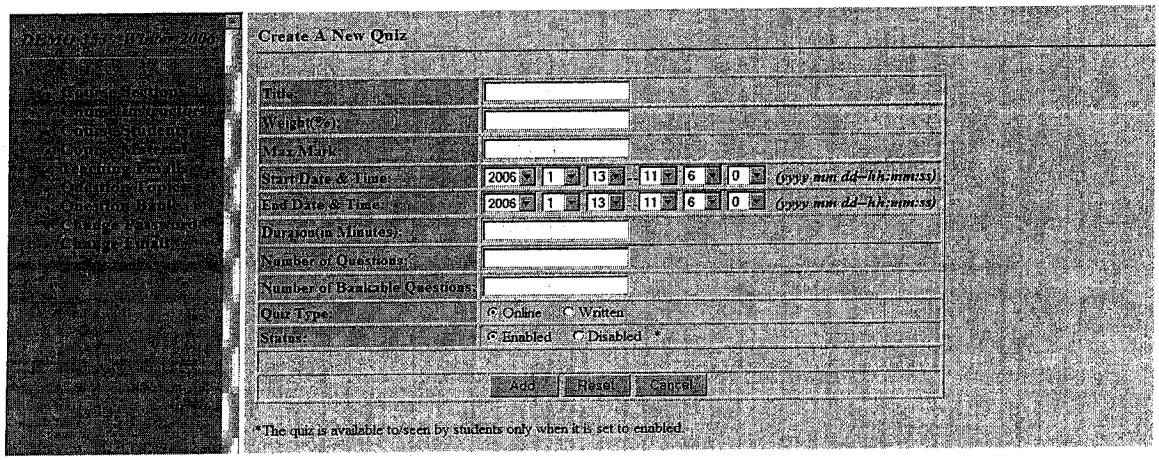


Figure 4.32 Create New Course Material

4.1.3.5 View the details of an assessment

To view the detail information of an assessment, click on the "Quiz Details" link (see Figure 4.30) for that assessment.

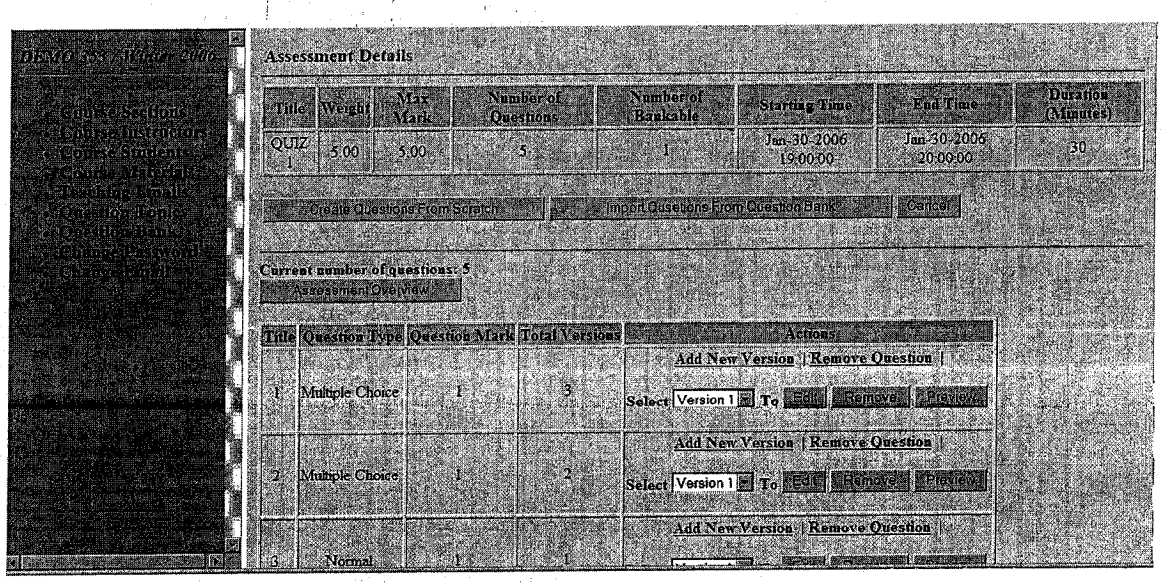


Figure 4.33 Assessment Details

4.1.3.6 Create questions for assessments

The Course Coordinator have two ways to create questions for an assessment: create questions from scratch or import questions from the question bank for the course.

4.1.3.6.1 Create questions from scratch

To create questions from scratch, click on the "Create Questions From Scratch" button shown in Figure 4.33. There are two steps to create a new question from scratch.

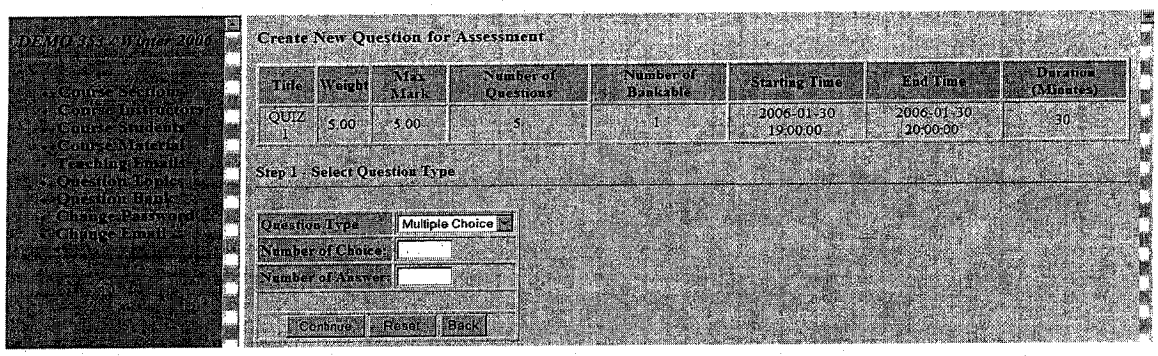


Figure 4.34 Create Questions from Scratch – Step 1

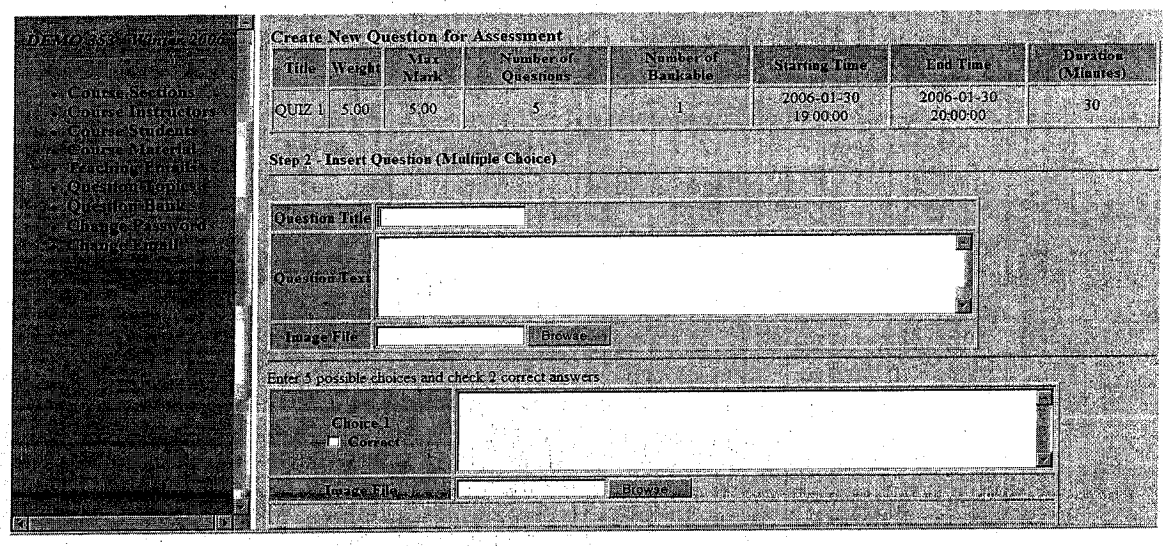


Figure 4.35 Create Questions from Scratch – Step 2

In step 1, the question type is selected (see Figure 4.34). For multiple choice questions, any number of choices and correct answers are allowed. In step 2, the question body is

input (see Figure 4.35). Images are allowed to be embedded into the question body. The explanations on the question answers can be input in the "comment" text box. For normal questions, the Course Coordinator can specify whether the users submit their answers in a text box or by uploaded files.

4.1.3.6.2 Import questions from question bank

Click on the "Import Questions From Question Bank" button shown in Figure 4.33, the Course Coordinator can import assessment questions one at a time directly from the existing question bank for the course. There are two steps to import new questions from the question bank. In step 1, the questions in the question bank are listed to be selected (see Figure 4.36). Before importing a question, the instructor can preview the question by clicking on the "Preview" button. Once the question is selected by clicking on the "Add to Assessment" button, the page for step 2 will be displayed (see Figure 4.37). In step 2, the Course Coordinator is asked to input a question title for the chosen question. The question title in an assessment must be unique; all versions of the chosen question will be imported into the assessment.

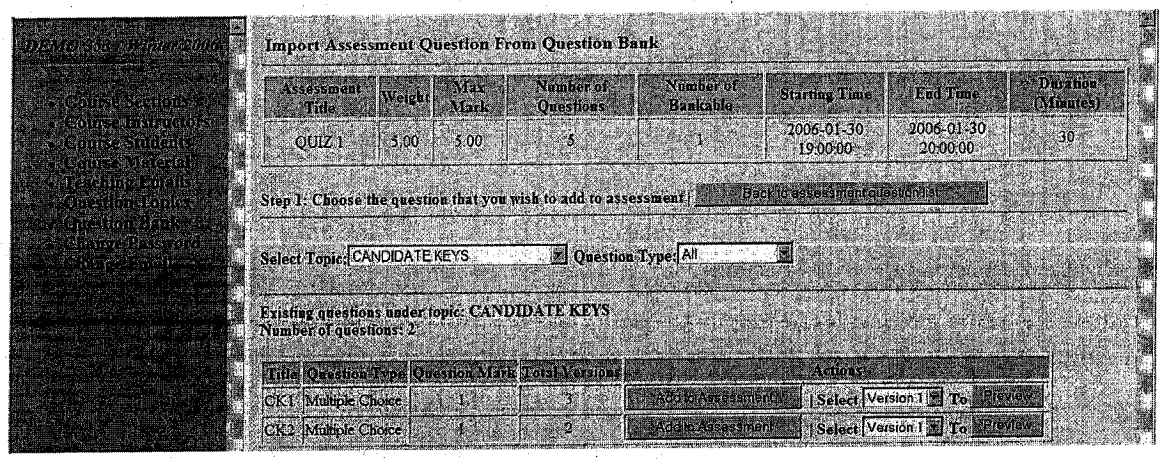


Figure 4.36 Import Questions from Question Bank – Step 1

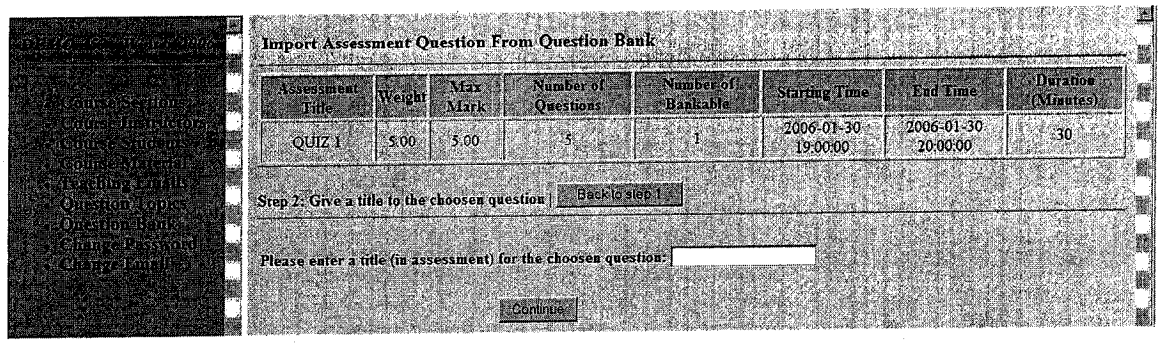


Figure 4.37 Import Questions from Question Bank – Step 2

4.1.3.7 Preview/edit/remove assessment question

These features are similar as the ones for the question bank, which are discussed in the sections 4.1.2.7 to 4.1.2.10.

4.1.3.8 Assessment overview

Click on the "Assessment Overview" button (see Figure 4.33), a new window will be opened to list all the questions ordered by question title and version number. The Course Coordinator could then print out these assessment questions for offline review.

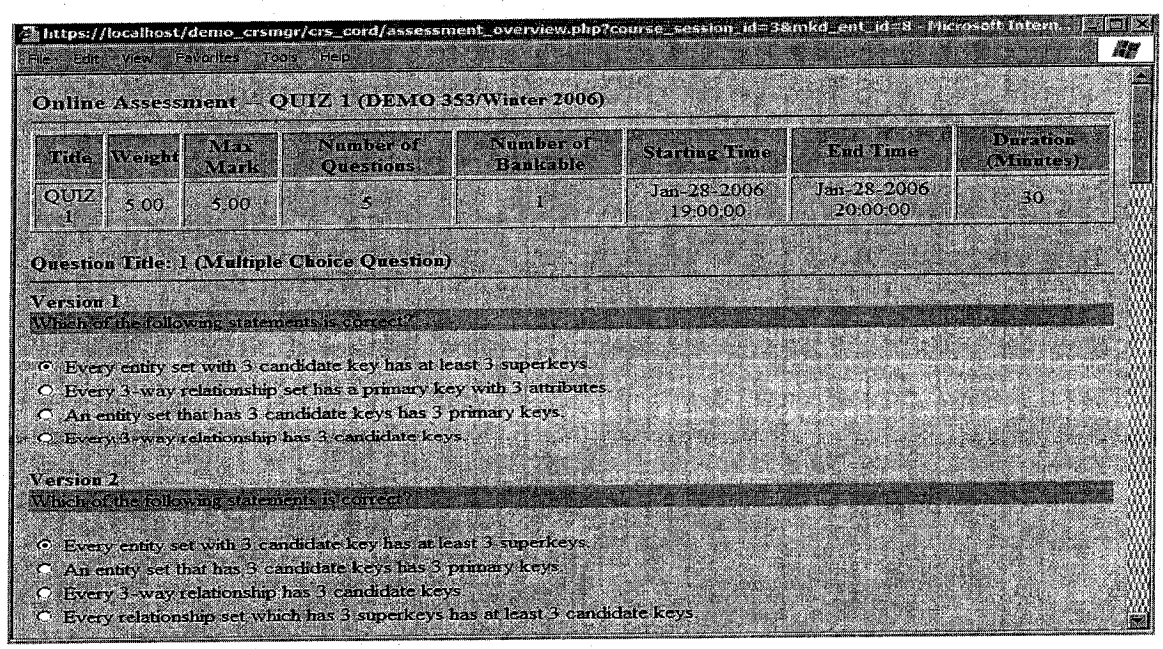


Figure 4.38 Assessment Overview

4.1.3.9 Dry-run of an assessment

To take a dry-run of an assessment, click on the "Try the quiz" link for that assessment (see Figure 4.30). The Course Coordinator is allowed to set the desired duration (in minutes) for the assessment in step 1 (see Figure 4.39). Click on the "Try now" button in step 2 (see Figure 4.40); a new window will be opened to show the first randomly chosen question of the assessment (see Figure 4.41). A timer will start to display the time left for the assessment at the status bar of the assessment window. The Course Coordinator is allowed to try the assessments at any time and as often as he wishes. Furthermore, he can review his performance on each try (see next section).

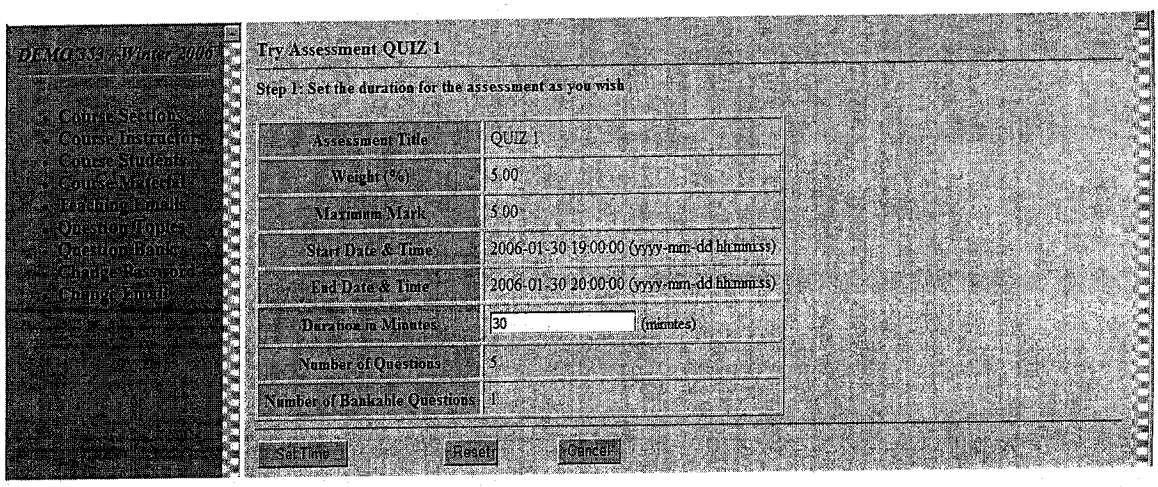


Figure 4.39 Try an Assessment – Step 1

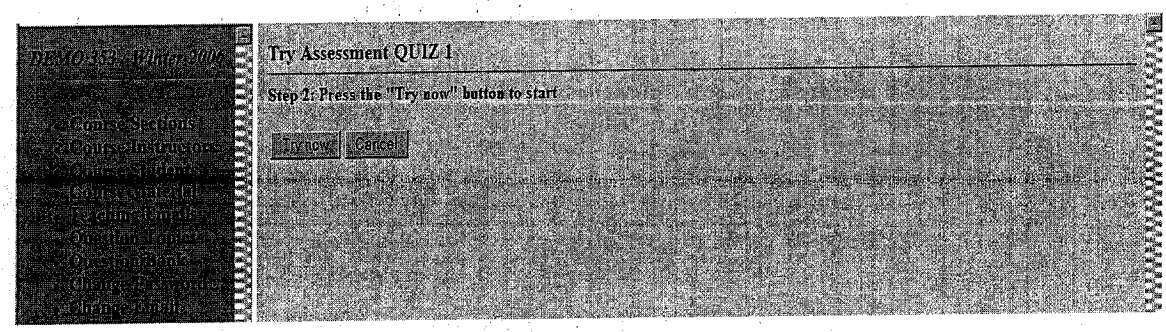


Figure 4.40 Try an Assessment – Step 2

4.1.3.10 Review you try

Once the user has tried an assessment, a "Review Your Try" link will appear for that assessment (see Figure 4.25). Click on this link to show the correct answers and the user's answers for this assessment (see Figure 4.38).

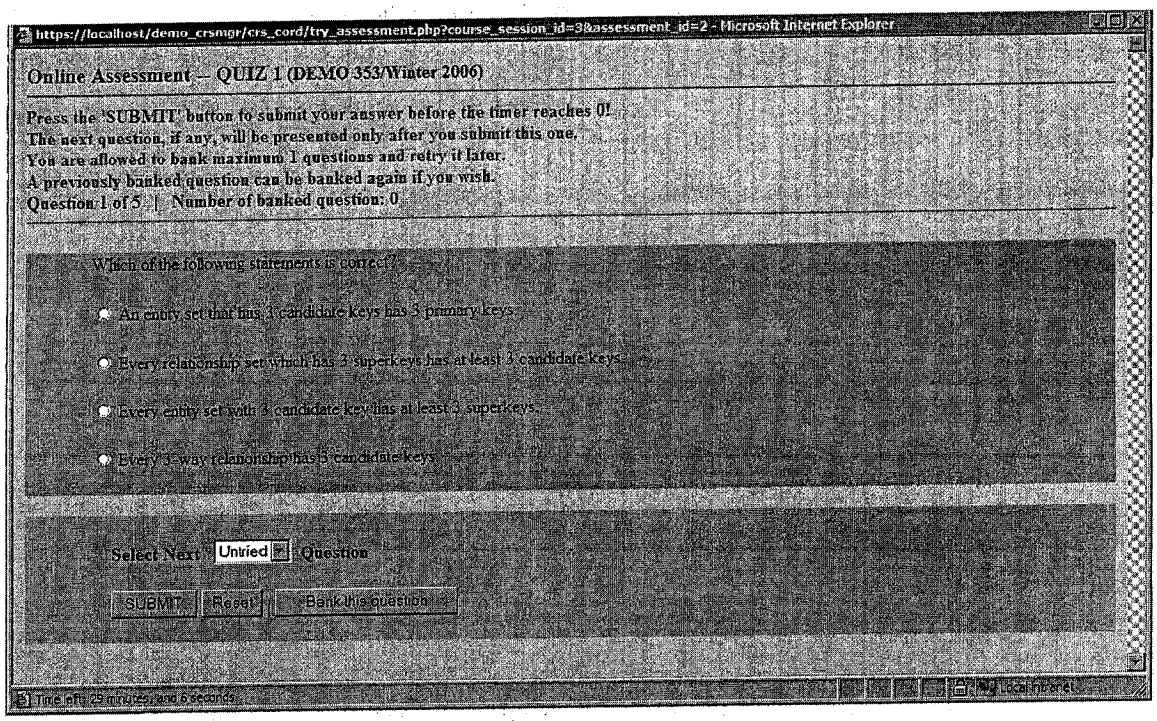


Figure 4.41 Online Assessment Window

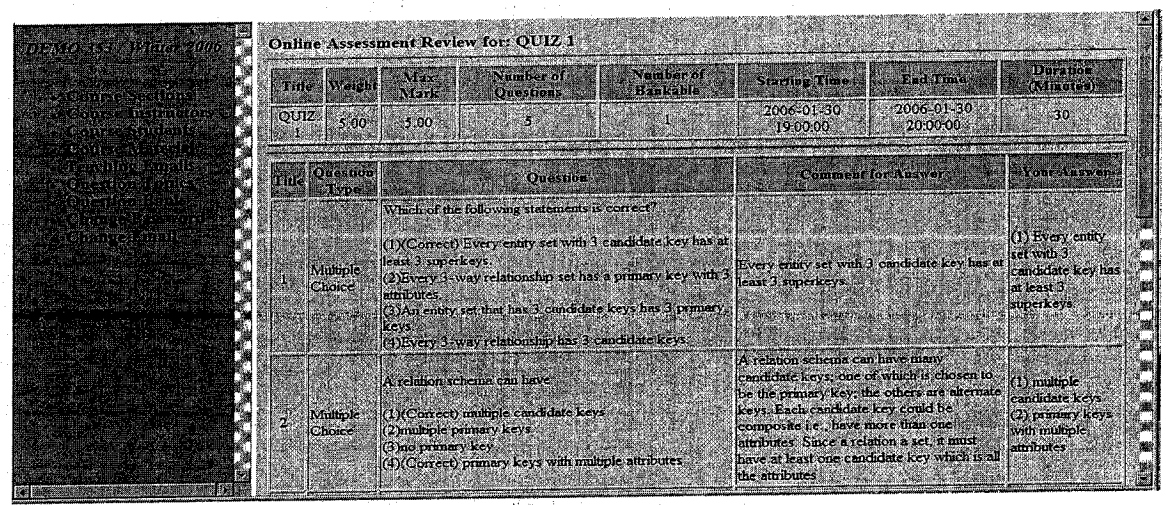


Figure 4.42 Review Your Try

4.1.3.11 Set time window for assessment review

When an online assessment has been completed by the students, the Course Coordinator can set up a time window during which the students can review their performance on the assessment and check the correct answers. Click on the "Quiz Review" link (see Figure 4.30) to show the page for setting time window for an assessment review (see Figure 4.43).

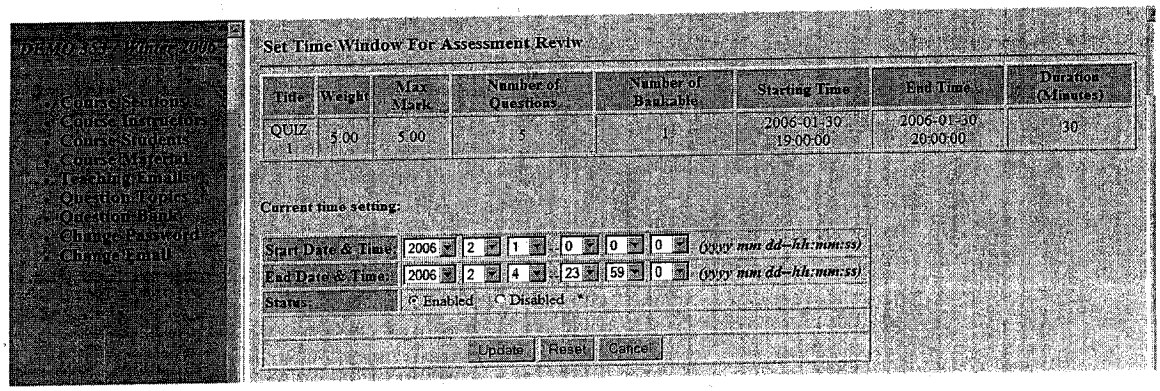


Figure 4.43 Set Time Window for Assessment Review

4.1.3.12 Set/update mark adjustments for assessment

Sometimes the multiple choice questions for an assessment might contain errors such as wrong answers and incomplete answers; very often these errors will not be found until the assessment is completed by the students and the marks are assigned to the students by the system automatically. When this happens, the instructor can have the system make the adjustments to the marks. This is done by using the "Set Mark Adjustments" link (see Figure 4.30) for the assessment that contains the error. The list of multiple choice questions for the assessment is displayed as in Figure 4.44. The instructor selects the questions that contain errors and makes a note of the reason for the adjustments. Once the setting is made, the system will add marks to those students who have attempted the

questions which were selected in the setting. If the instructor reuses the setting for the adjustments, the system will re-adjust the marks according to the new setting automatically. Those students who did not attempt an adjusted question would not benefit from this adjustment.

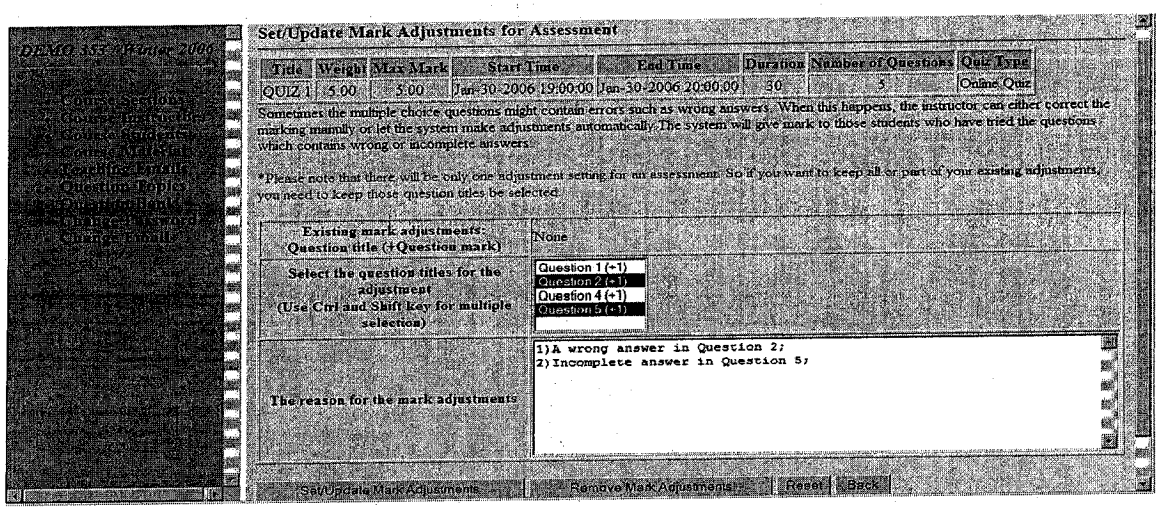


Figure 4.44 Set Mark Adjustments for Assessment

4.1.4 Teaching Emails

This is a common feature for the Course Coordinator and the Course Instructor. CrsMgr provides a simple email feature to allow the Course Coordinator or the Course Instructor to send emails to predefined user group. The Course coordinator is able to send teaching emails to the following predefined groups: all student, all group leaders, all instructors, all tutors, all lab instructors, or all markers in the course session. Similarly, the Course Instructor is able to send teaching emails to the following predefined user groups: all student, all group leaders, all tutors, all lab instructors, or all markers in the course section. We will describe the detail functionality for the teaching emails in the following sections and use the pages for the Course Coordinator as an example; the pages for the Course Instructor are similar.

4.1.4.1 Teaching email list

Click on the "Teaching Emails" link in the left frame of the pages for the Course Coordinator; the teaching emails sent to date are displayed (see Figure 4.45). The last 10 emails that were previously sent are displayed by default.

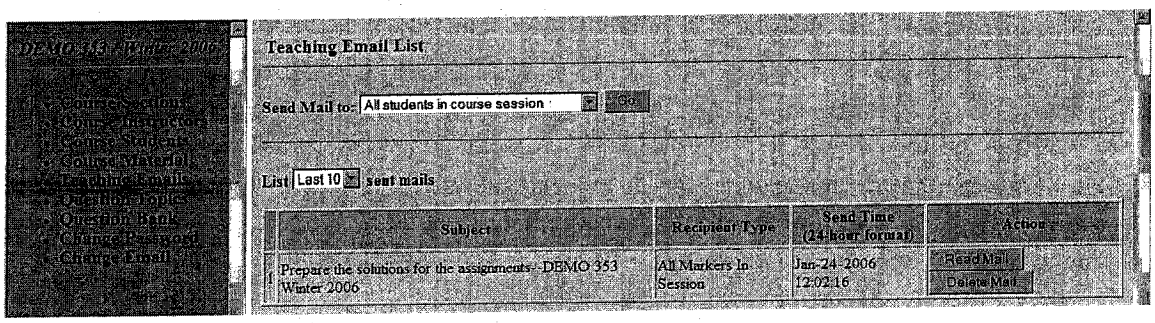


Figure 4.45 Teaching Email List

4.1.4.2 Send teaching emails

To send a teaching email, select one of the predefined recipient types from the pull-down list and click on the "Go" button shown in Figure 4.41. For emails to be sent to the students, the Course Coordinator can specify whether to send the student account information (user name and password) together with the email (see Figure 4.42). The default is to send the student account information.

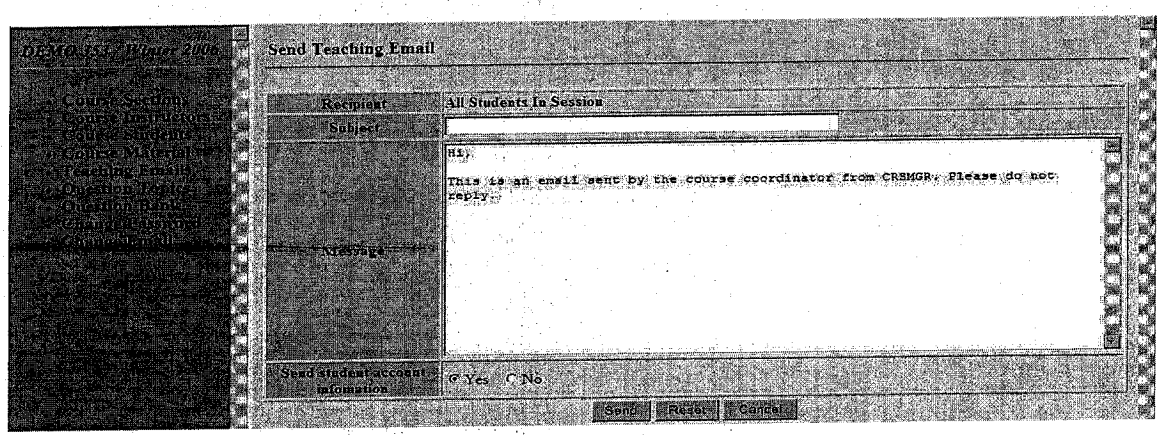


Figure 4.46 Send Teaching Emails

4.1.4.3 Read teaching emails

To review a previous email, click on the "Read Mail" button shown in Figure 4.45 and a new window is opened to show the email (see Figure 4.47).

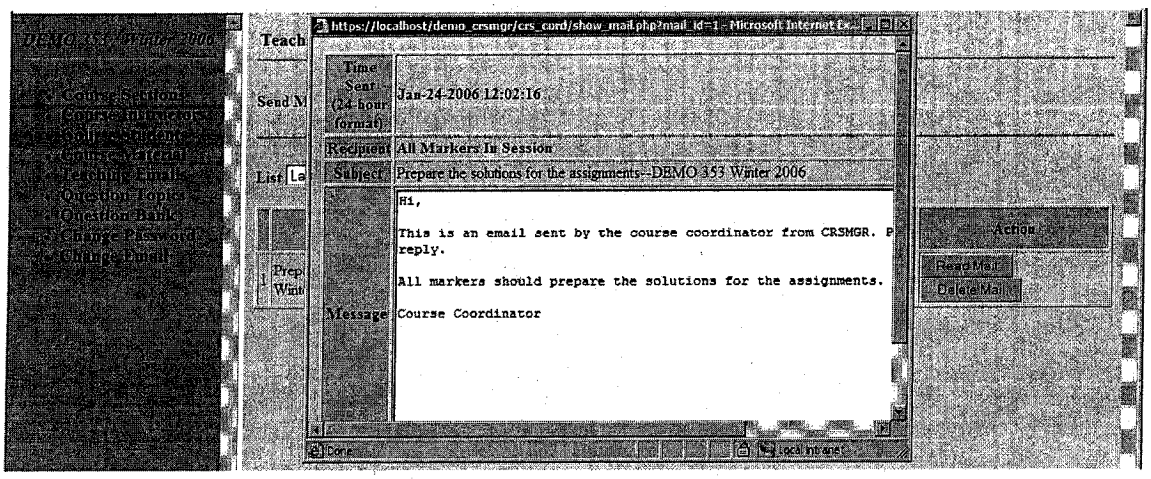


Figure 4.47 Read Sent Teaching Emails

4.1.4.4 Delete teaching emails

To delete a sent teaching email, click on the "Delete Mail" button shown in Figure 4.45.

4.1.5 Common Functionalities for All Teaching Assistants

In CrsMgr, teaching assistants (TAs) are classified into three types: Course Marker, Course Tutor, and Lab Tutor. We will describe the common functionality for the TAs in the following sections and use the pages for the Course Marker as an example; the pages for the other type of TAs are similar.

4.1.5.1 Contact information

Click on the "Contact Information" link in the left frame of the pages for Course Marker, the contact information on course instructor and all TAs is listed (see Figure 4.48).

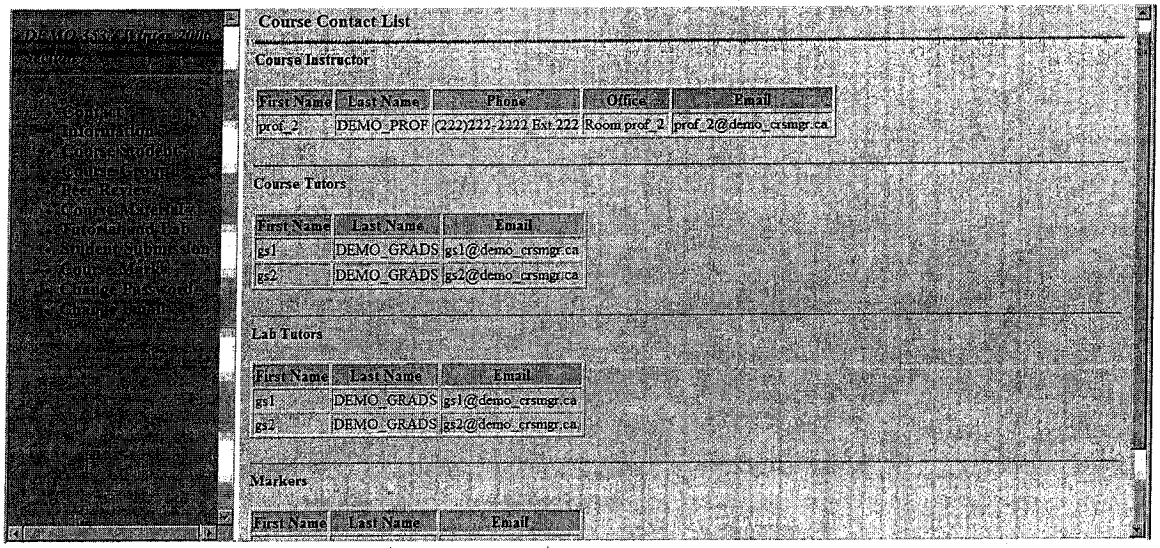


Figure 4.48 Course Contact List -- TAs

4.1.5.2 Course student

Click on the "Contact Student" link in the left frame of the pages for the Course Marker, the information for the students in course is displayed (see Figure 4.49).

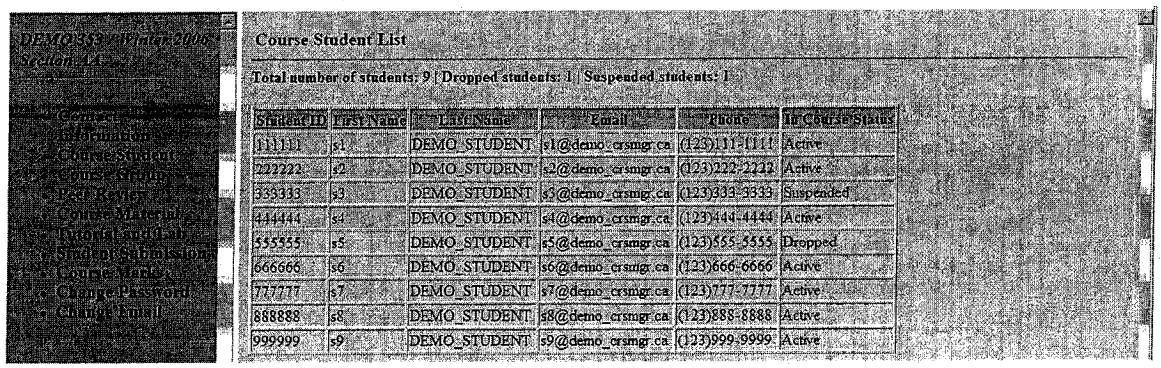


Figure 4.49 Course Student List -- TAs

4.1.5.3 Course material list

Click on the "Course Materials" link in the left frame of the pages for the Course Marker; all the course materials are displayed by types. The course markers can choose to view only some selected types of course materials and keep others shown as hidden (see Figure 4.50).

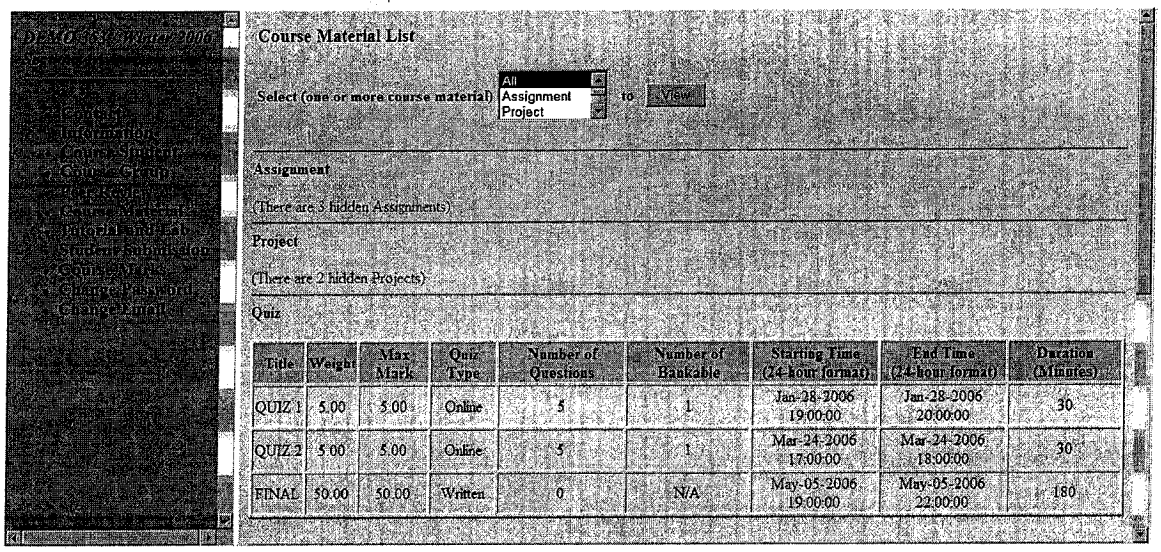


Figure 4.50 Course Material List -- TAs

4.1.5.4 Tutorial and lab

Click on the "Tutorial and Lab" link in the left frame of the pages for the Course Marker; the detail information on the tutorials and lab time slots is displayed (see Figure 4.51).

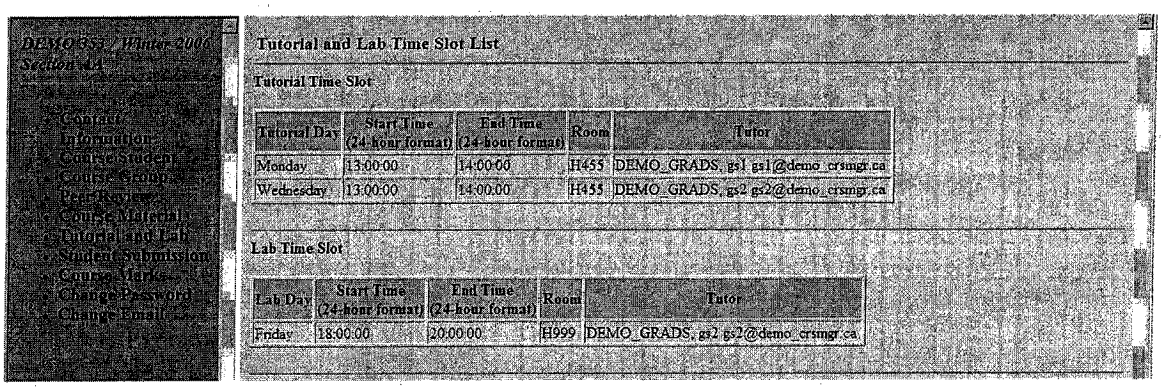


Figure 4.51 Tutorial and Lab Time Slot List -- TAs

4.2 System Administrator

A system administrator has all the access privileges of the following system access roles: System Administrator, Department Administrator, Course Coordinator, Course Instructor, and Thesis Supervisor. When a system administrator is logged in, all these access roles

are listed to be chosen. In this section, we only discuss the functionality of System Administrator. The feature for changing email has been discussed in section 4.1.1.6.

4.2.1 Departments

In the left frame of the pages for the System Administrator, a "Department" link is provided to group together the functionality required for adding and managing departments and their administrators.

4.2.1.1 List existing departments

Click on the "Department" link on the Main Menu; the list of existing departments is displayed in the main frame of the page (see Figure 4.52).

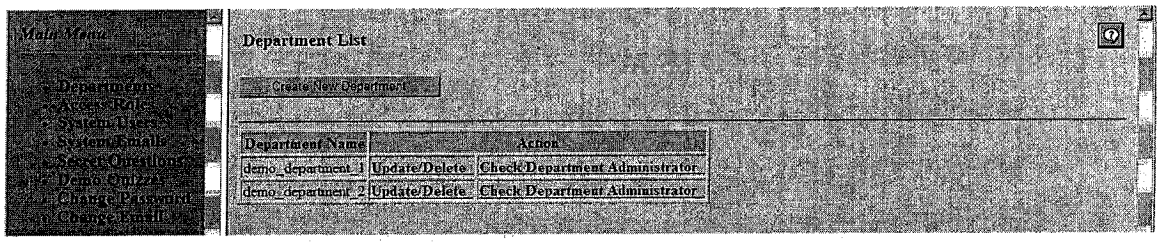


Figure 4.52 Department List

4.2.1.2 Create new departments

To create a new department, click on the "Create New Department" button (see Figure 4.52). Each department name is unique in the system.

4.2.1.3 Update/delete departments

To update the information of a department or to delete a department, click on the "Update/Delete" link for that department (see Figure 4.52). A referenced department, for which courses are offered, is not allowed to be deleted.

4.2.1.4 List existing department administrators

Click on the "Check Department Administrator" link (see Figure 4.53) for that department to display the information of existing department administrators (see Figure 4.53). To sort the department administrators by different orders, click on one of the table headers: "Professor ID", "Last Name", "First Name", or "User Name".

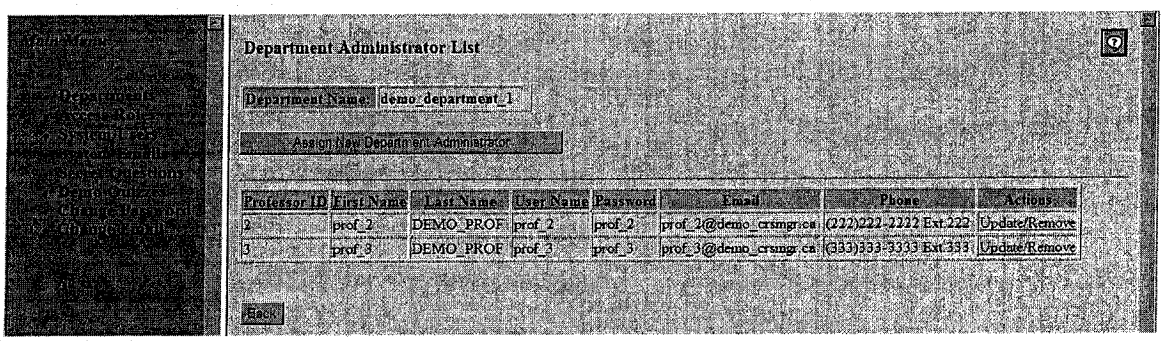


Figure 4.53 Department Administrator List

4.2.1.5 Assign new department administrators

Multiple department administrators are allowed for a department. To assign a new department administrator, click on the "Assign New Department Administrator" button (see Figure 4.53) to show the page (see Figure 4.54). The professors in department are listed to be chosen as the new department administrators.

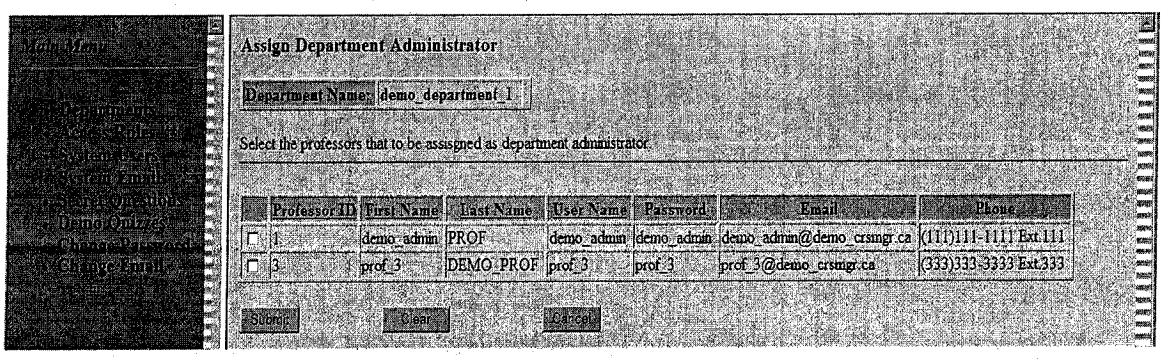


Figure 4.54 Assign Department Administrator

4.2.1.6 Update/remove department administrators

To update the information of a department administrator or remove a department administrator, click on the "Update/Remove" link for that administrator (see Figure 4.53).

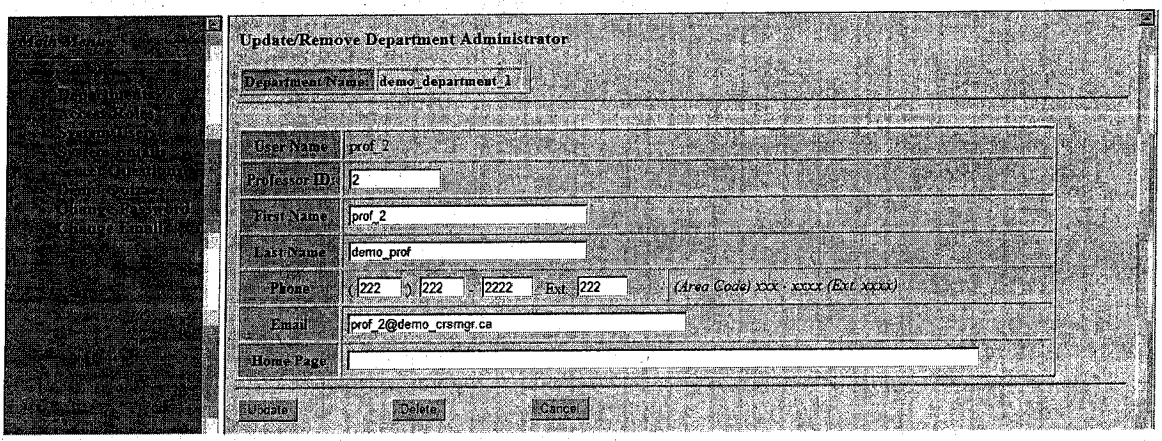
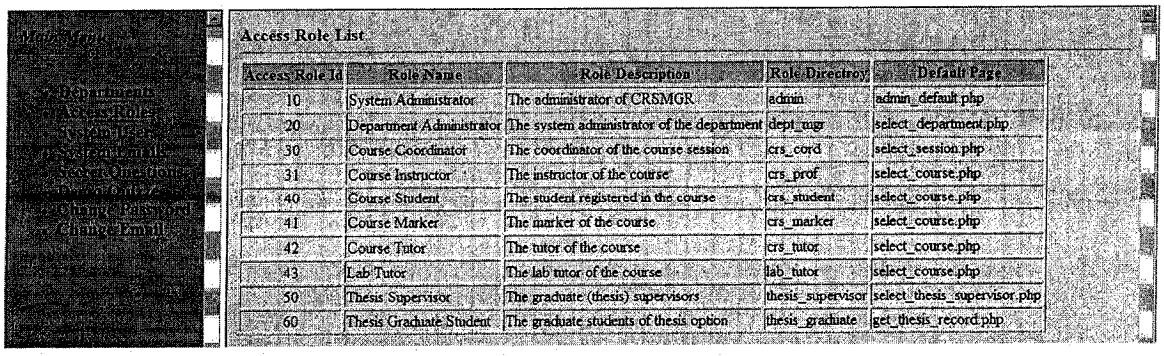


Figure 4.55 Update/Remove Department Administrator

4.2.2 Access Roles

As we mentioned before, there are ten different system access roles in CrsMgr. Click on the "Access Roles" link in the left frame of the pages for the System Administrator; the detail information for these access roles is displayed (see Figure 4.56). Since the functionalities of these roles are programmed in, they cannot be modified except through reprogramming.


Access Role List

Access Role Id	Role Name	Role Description	Role Directroy	Default Page
10	System Administrator	The administrator of CRSMGR	admin	admin_default.php
20	Department Administrator	The system administrator of the department	dept_mgr	select_department.php
30	Course Coordinator	The coordinator of the course session	crs_cord	select_session.php
31	Course Instructor	The instructor of the course	crs_prof	select_course.php
40	Course Student	The student registered in the course	crs_student	select_course.php
41	Course Marker	The marker of the course	crs_marker	select_course.php
42	Course Tutor	The tutor of the course	crs_tutor	select_course.php
43	Lab Tutor	The lab tutor of the course	lab_tutor	select_course.php
50	Thesis Supervisor	The graduate (thesis) supervisors	thesis_supervisor	select_thesis_supervisor.php
60	Thesis Graduate Student	The graduate students of thesis option	thesis_graduate	get_thesis_record.php

Figure 4.56 System Access Role List

4.2.3 System Users

In the left frame of the pages for the System Administrator, a "System Users" link is provided to group together the functionality required for managing the system users.

4.2.5.1 List existing system users

Click on the "System Users" link in the left frame of the pages for the System Administrator; the list of all existing CrsMgr system users is displayed (see Figure 4.57). There are two significant types of system users: professor and student. The existing professors and students are listed in two tables. Both types of users are shown by default. However, we can choose to view only one type of users. To sort the users by their user names, click on the "User Name" table header. Similarly, click on one of the "Professor ID", "Student ID", "First Name" and "Last Name" table headers to sort the users in a different order.

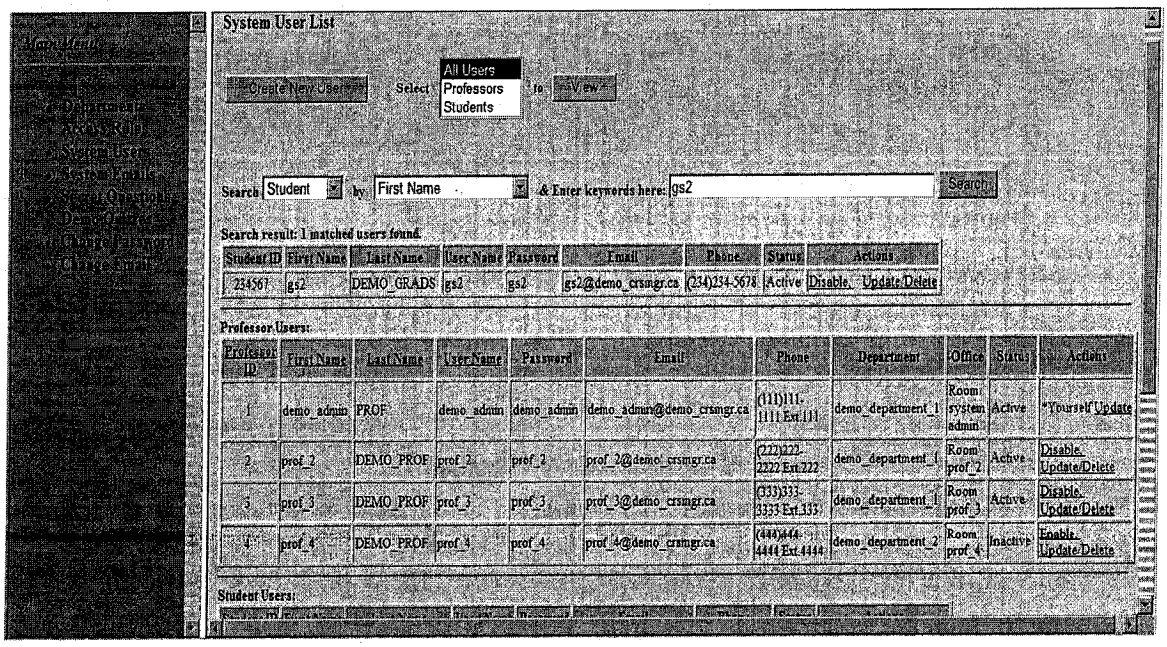


Figure 4.57 System User List

4.2.5.2 Search existing system users

A searching feature is provided to search users by the ID, first name, last name, or user name (see Figure 4.57).

4.2.5.3 Enable/disable system access of the users

To disable the system access privilege of a user, click on the "Disable" link (see Figure 4.57) for that user and the status of that user is changed to "Inactive". Similarly, to enable the system access privilege of an "Inactive" user, click on the "Enable" link for that user.

4.2.5.4 Create new system users

To create a new system user, click on the "Create New User" button (see Figure 4.57) to show the page (see Figure 4.58). By default, a new user is created with system access enabled. However, an active user can do nothing more except to log in to the system until he/she is assigned a specific system access role. For example, a new created "student" user will not be able to access the course pages until he/she is assigned the Course Student access role by being inserted into a course.

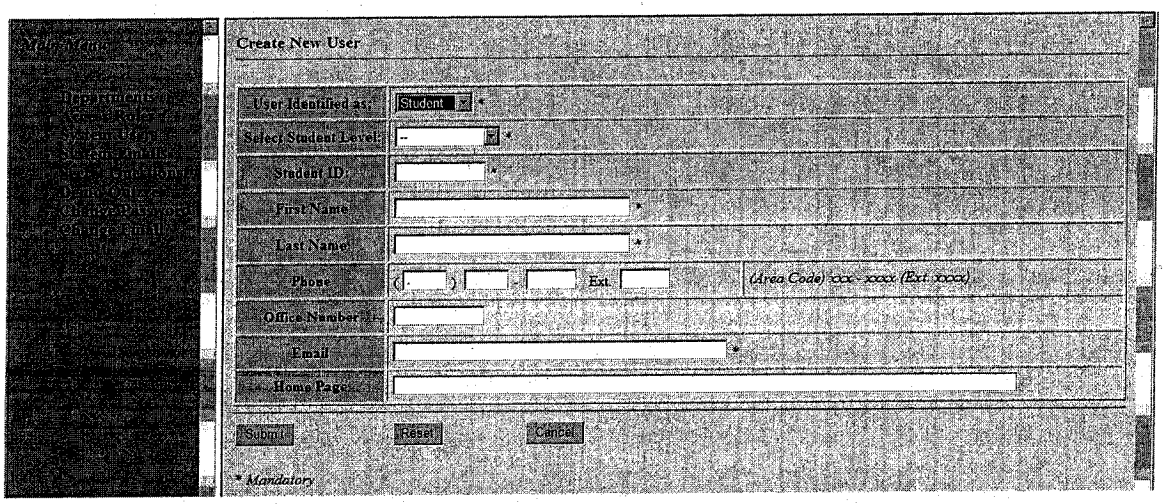


Figure 4.58 Create New System Users

4.2.5.5 Update/delete system user

To update or delete the information of a system user, click on the "Update/Delete" link (see Figure 4.57) for that user to show the page (see Figure 4.59). In the system, different users with same names are allowed. However, the student ID or professor ID of the users must be unique. The deletion of a system user that is already referenced is not allowed.

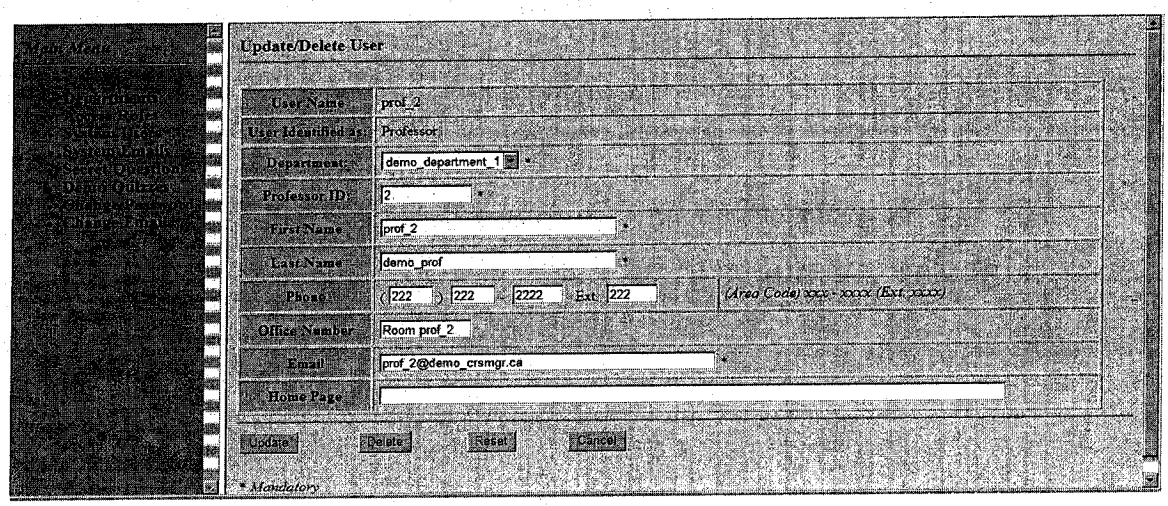


Figure 4.59 Update/Delete System Users

4.2.4 System Emails

Predefined system emails are sent to the users when certain evens happen. For example, when a student is inserted into a course, a system email which contains the user account information will be sent to his/her email address automatically by the system.

4.2.4.1 List existing system emails

Click on the "System Emails" link in the left frame of the pages for the System Administrator; the list of existing system emails is displayed (see Figure 4.60). Currently, there are 13 predefined system emails.

4.2.4.2 View/edit system emails

To view or edit the content of a system email, click on the square symbol besides the name of a system email (see Figure 4.60). The system message shown in Figure 4.61 is the one to be sent to course students when they are inserted into a course.

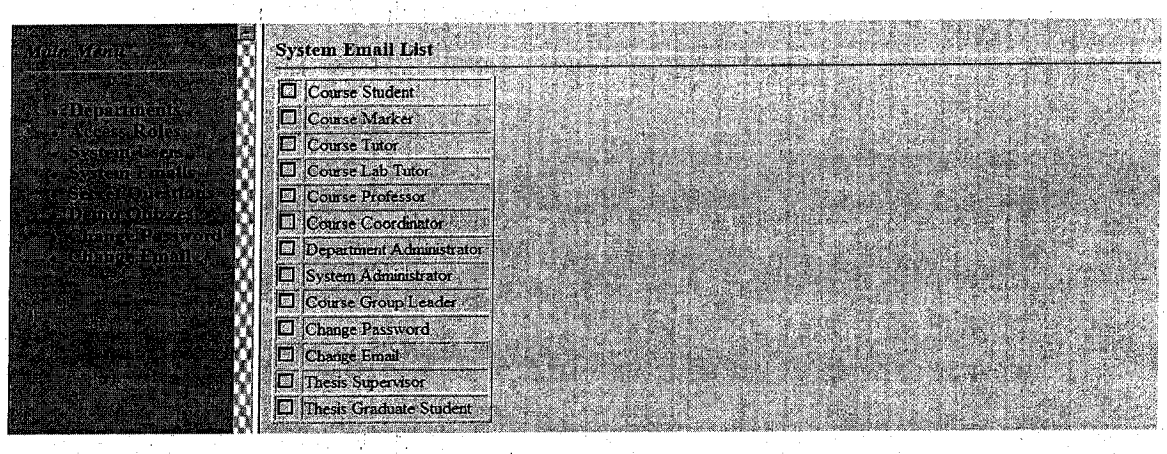


Figure 4.60 System Email List

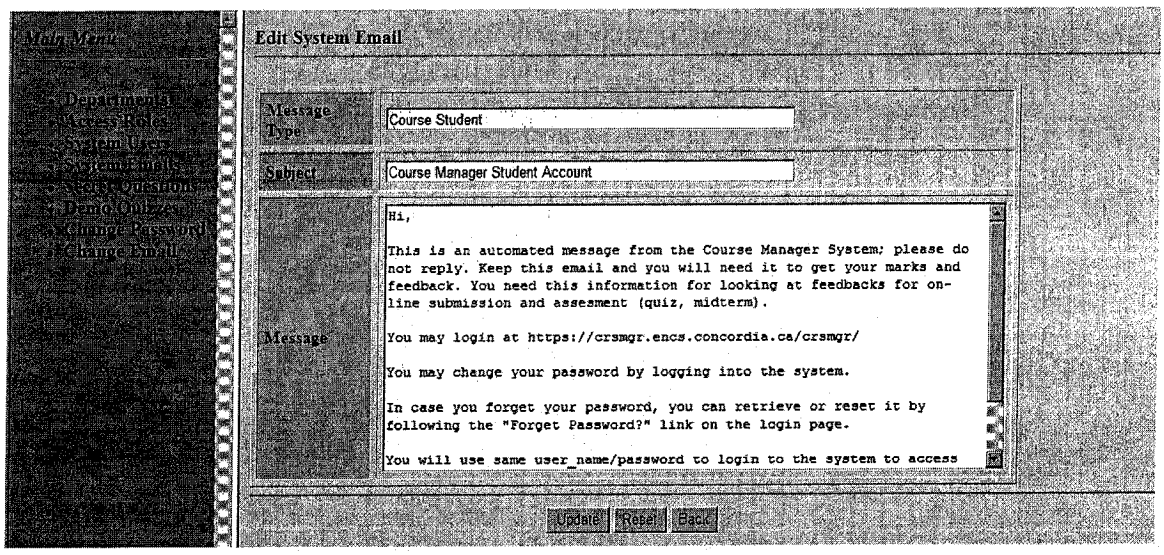


Figure 4.61 View/Edit System Emails

4.2.5 Secret Questions

As we discussed in section 4.1.1.3, users are required to either choose three secret

questions from the predefined set or create their own three secret questions and answers during their first login. These secret questions and answers are used to verify the identities of the users in case they forget their passwords. Six predefined secret questions would be selected randomly and shown to the users to allow them to fill in the answers.

4.2.5.1 List existing secret questions

Click on the "Secret Questions" link in the left frame of the pages for the System Administrator; the list of existing predefined secret questions is displayed (see Figure 4.62).

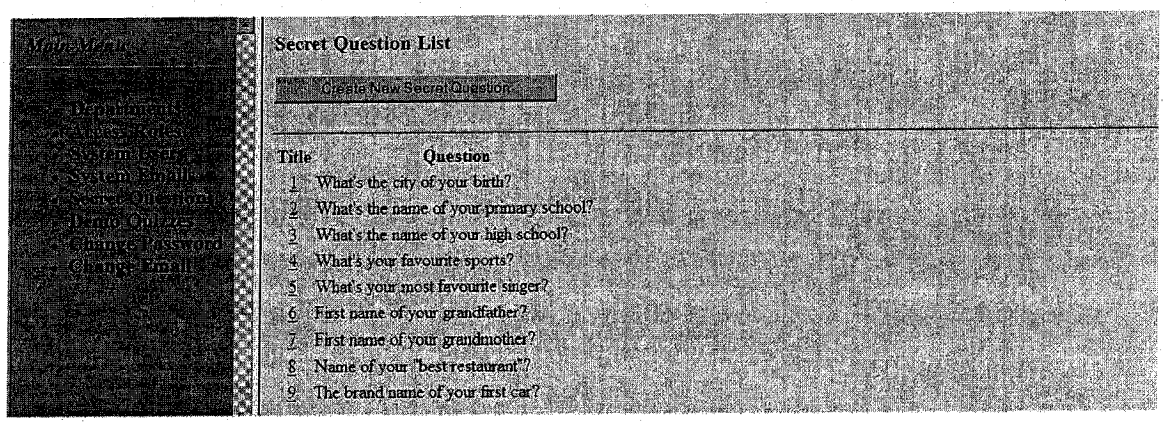


Figure 4.62 Secret Question List

4.2.5.2 Create new secret questions

To create a new secret question, click on the "Create New Secret Question" button shown in Figure 4.62. The title of each secret question must be unique in the system.

4.2.5.3 Update/delete secret questions

To update or delete a secret question, click on the title link (see Figure 4.62) for that question.

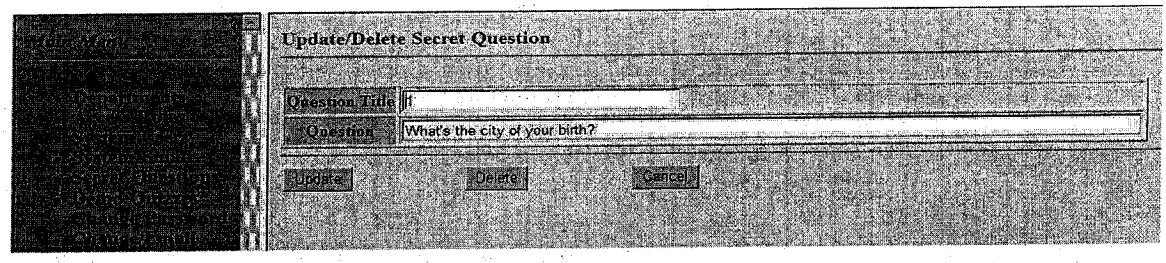


Figure 4.63 Update/Delete Secret Questions

4.2.6 Demo Quizzes

The System Administrator may create some general demo quizzes to show the students how the online assessments functions in CrsMgr. It is ironic that many computer science students resist the online quiz. The demo quiz was created to get over their resistant.

4.2.6.1 List existing demo quizzes

Click on the "Demo Quizzes" link in the left frame of the pages for the System Administrator; the list of existing demo quizzes is displayed (see Figure 4.64).

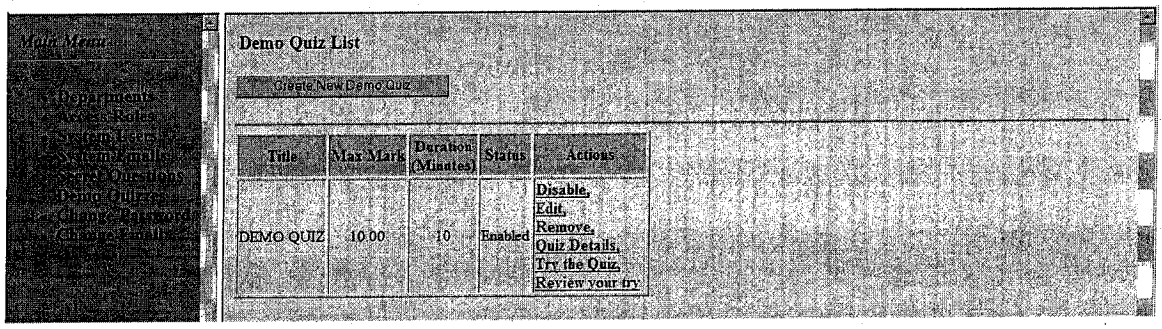


Figure 4.64 Demo Quiz List

4.2.6.2 Create new demo quizzes

To create a new demo quiz, click on the "Create New Demo Quiz" button shown in Figure 4.64. The title of each demo quiz must be unique in the system.

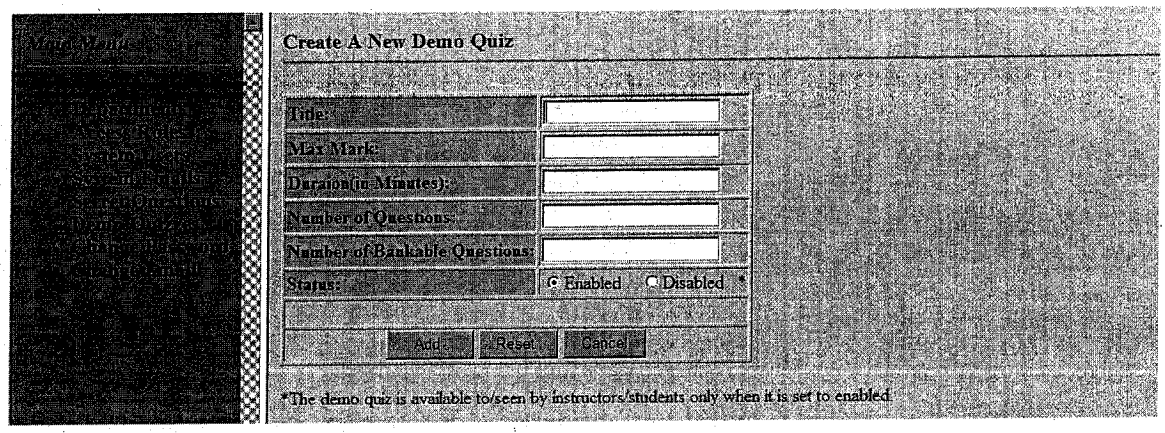


Figure 4.65 Create Demo Quizzes

4.2.6.3 Disable/enable demo quizzes

A demo quiz is accessible to the users only when it is set to "Enabled". To hide a demo quiz, simply click on the "Disable" link (see Figure 4.64). Similarly, click on the "Enable" link of a "Disabled" demo quiz to switch its status back to "Enabled".

4.2.6.4 Edit /remove demo quizzes

To update the parameters of a demo quiz, click on the "Edit" link (see Figure 4.64). Similarly, to remove a demo quiz, click on the "Remove" link.

4.2.6.5 Actions on demo quizzes

To view the detail information of a demo quiz, to create/edit/preview/remove questions for a demo quiz, please refer to the section 4.1.3.5 to section 4.1.3.10. To take an overview or dry run of a demo quiz, or to review your performance on the dry run, please refer to the section 4.1.3.11 to section 4.1.3.13.

4.2.7 Change Password

The System Administrator is allowed to change not only his/her own password, but also

the passwords of all other system users. To locate the user for the password change, the System Administrator can either select the user from the pull-down list or search the user using values for field such as the user's first name (see Figure 4.66).

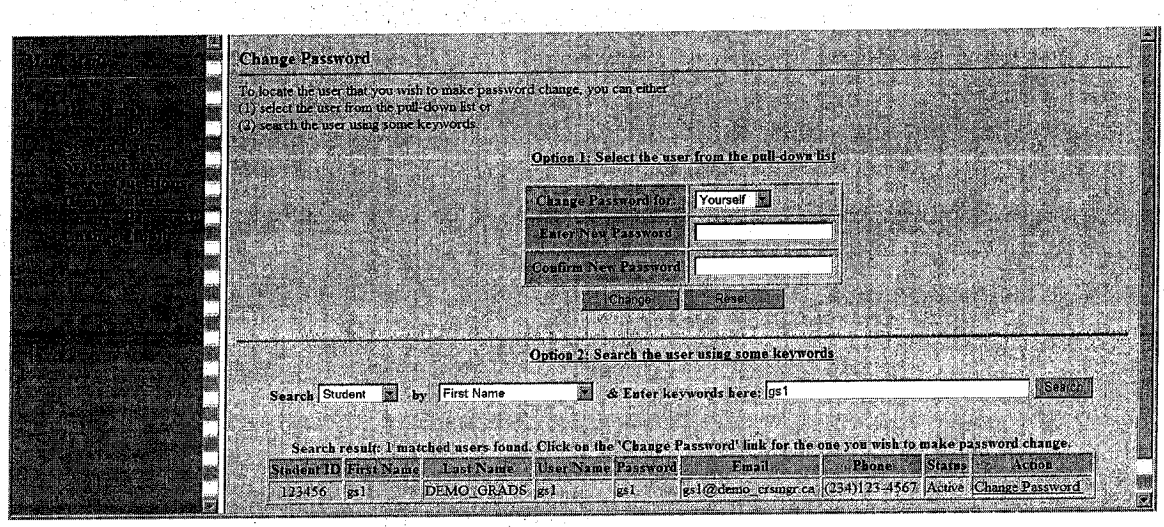


Figure 4.66 Change Passwords – System Administrator

4.3 Department Administrator

A department administrator has all the access privileges of the following system access roles: Department Administrator, Course Coordinator, Course Instructor, and Thesis Supervisor. When a department administrator is logged in, all these access roles are listed to be chosen. The feature for changing email has been discussed in section 4.1.1.6.

4.3.1 Courses

Click on the "Courses" link in the left frame of the pages for the Department Administrator; the submenus and the overall feature introduction for the "Courses" menu is displayed (see Figure 4.67).

4.3.1.1 Course list

Click on the "Courses: List" link on the submenu, the list of existing courses in the department is displayed (see Figure 4.68).

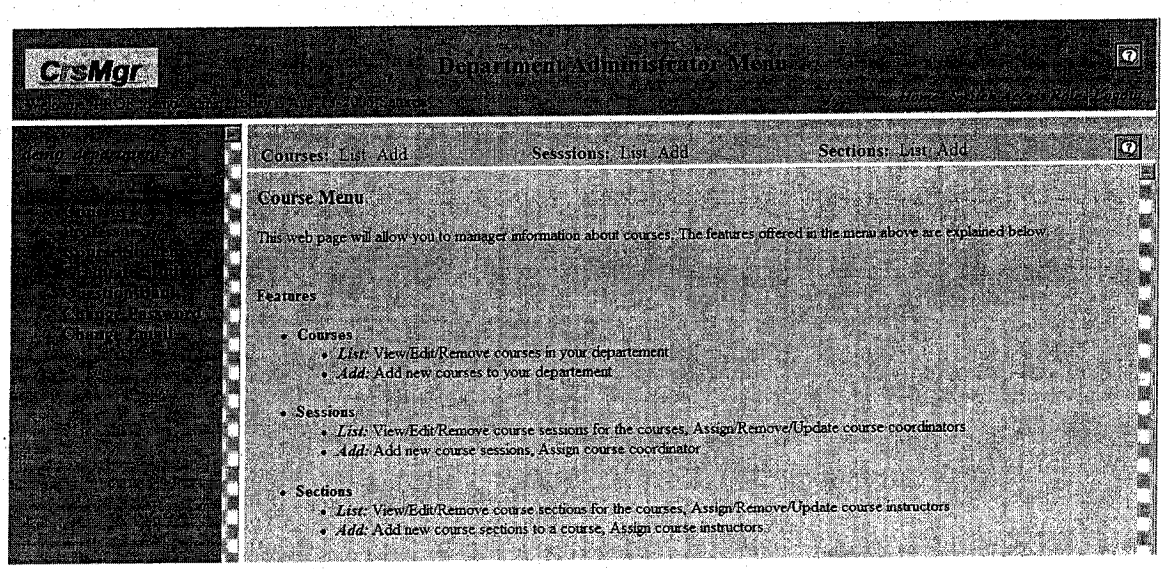


Figure 4.67 Course Menu

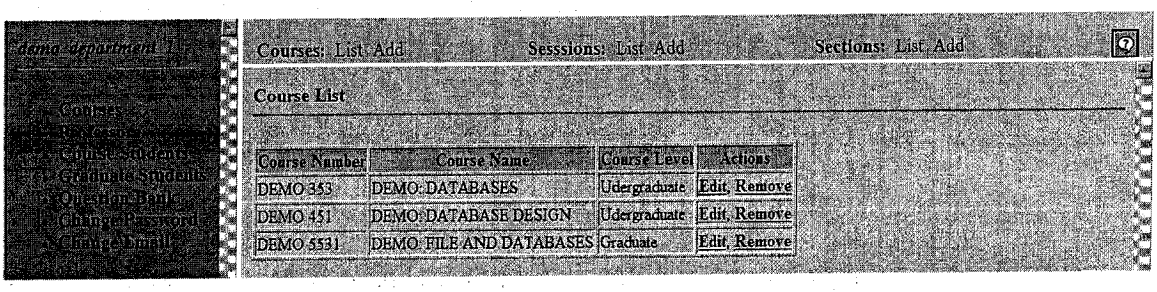


Figure 4.68 Course List

4.3.1.2 Create new courses

Click on the "Courses: Add" link on the submenu to show the form for creating new courses (see Figure 4.69). The course number and course name of a course must be unique in the system.

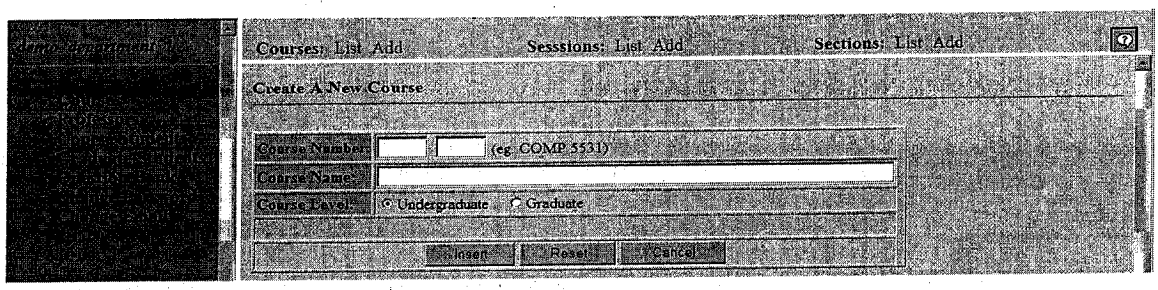


Figure 4.69 Create New Courses

4.3.1.3 Edit/remove courses

To edit or delete the information of a course, click on the "Edit" link or "Remove" link for that course (see Figure 4.68). The deletion of a referenced course is not allowed.

4.3.1.4 List existing course sessions

To show the course sessions for a selected course and year, click on the "Sessions: List" link on the submenu; choose the course name and year before pressing the "View" button. Figure 4.70 shows the page for listing the course sessions.

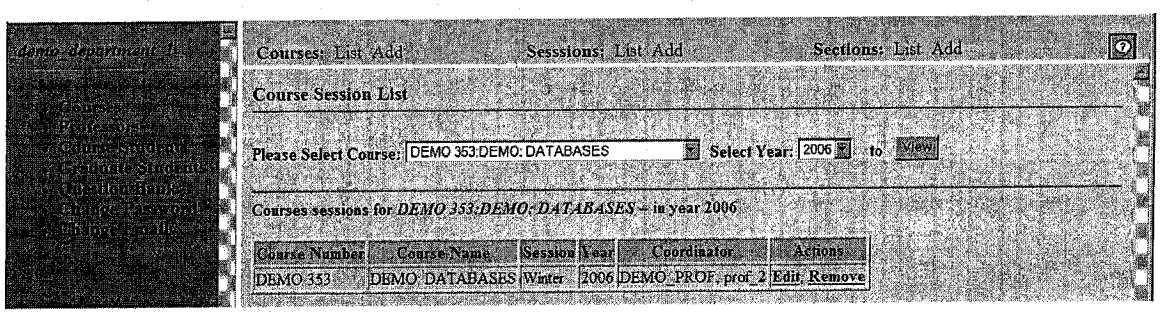


Figure 4.70 Course Session List

4.3.1.5 Create new course sessions

Click on the "Sessions: Add" link on the submenu to show the page for creating new course sessions (see Figure 4.71). The course coordinator can be assigned during or after the session creation. When a course coordinator is assigned to a course session, an

appropriate system email will be sent to the course coordinator.

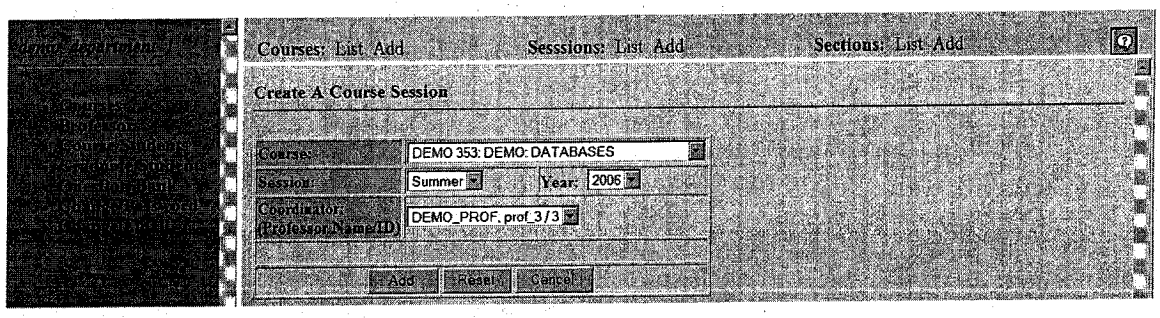


Figure 4.71 Create New Course Sessions

4.3.1.6 Edit/remove course sessions

To edit or delete the information of a course. session, click on the "Edit" link or "Remove" link for that course session (see Figure 4.70). If the course coordinator is changed for a course session, an appropriate system email will be sent to the new course coordinator. The deletion of a referenced course session is not allowed.

4.3.1.7 List existing course sections

To show the course sections for a selected year and term, click on the "Sections: List" link on the submenu; choose the year and term before pressing the "View" button.

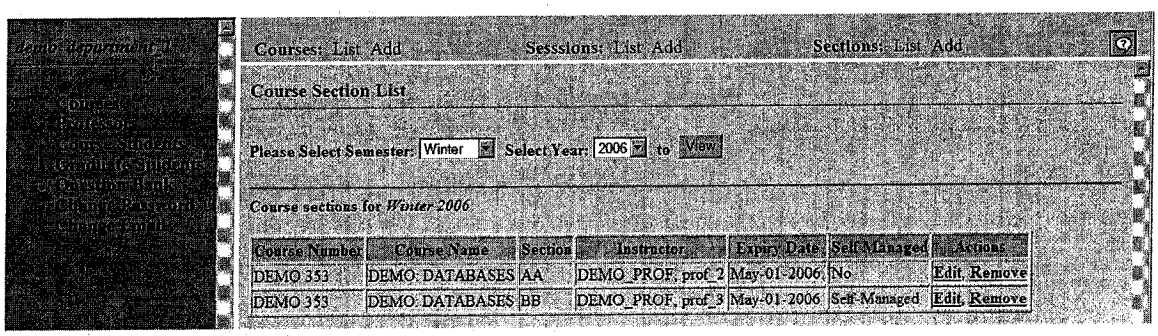


Figure 4.72 Course Section List

4.3.1.8 Create new course sections

To create a new course section, click on the "Sections: Add" link on the submenu and the

page for creating new course section will be shown (see Figure 4.73). The course instructor can be assigned during or after the section creation. When a course instructor is assigned to a course section, an appropriate system email will be sent to the course instructor. For each course section, the expiry date of student access is defined. After this expiry date, the students in the course section cannot access the pages for this course section. A course section can be either coordinated or self-managed. Only the instructors for the self-managed sections are allowed to create their own course marked entities including assignments, projects and quizzes. All coordinated sections share common course materials created by the course coordinator. However, instructors for the coordinated sections are still allowed to create their own course materials including demo quizzes, course outline, announcements, lecture notes, solutions, and tutorial slides. The instructors for the self-managed sections could decide to use the common course material created by the course coordinator or to create their own.

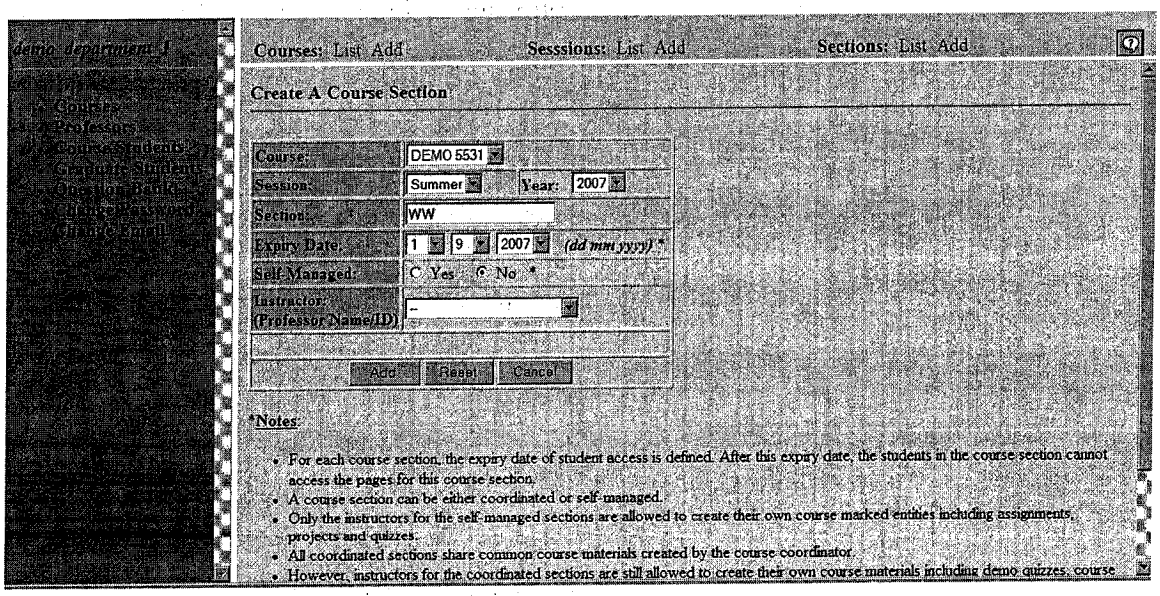


Figure 4.73 Create New Course Sections

4.3.1.9 Edit/remove course sections

To edit or delete the information of a course section, click on the "Edit" link or "Remove" link for that course section (see Figure 4.72). If the course instructor is changed for a course section, an appropriate system email will be sent to the course instructors. The deletion of a referenced course section is not allowed.

4.3.2 Professors

Click on the "Professors" link in the left frame of the pages for Department Administrator, the submenus and the overall feature introduction for the "Professors" menu is displayed.

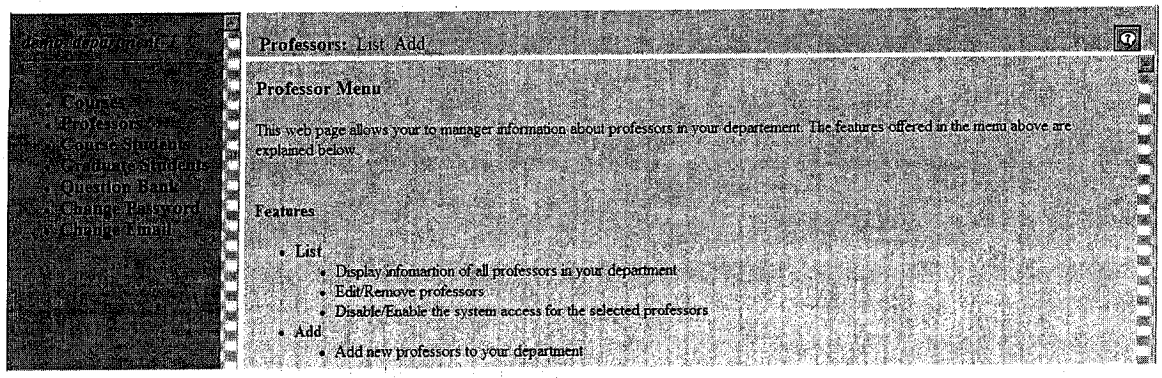


Figure 4.74 Professor Menu

4.3.2.1 List existing professors

Click on the "Professors: List" link on the submenu, the list of existing courses in the department is displayed (see Figure 4.75). To sort the professors by the professor IDs, click on the "Professor ID" table header. Similarly, click on one of the "First Name", "Last Name", and "User Name" table headers to sort the professors in different orders.

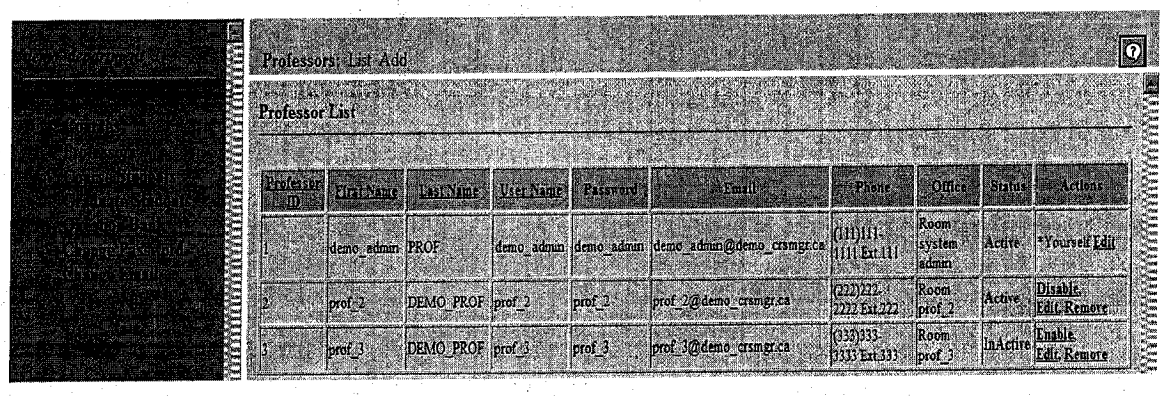


Figure 4.75 Professor List

4.3.2.2 Enable/disable system access for the professors

To disable the system access privilege of a professor, click on the "Disable" link (see Figure 4.75) for that professor and the status of that professor is changed to "Inactive". Similarly, to enable the system access privilege of an "Inactive" professor, click on the "Enable" link for that professor.

4.3.2.3 Edit/remove professors

To edit the information for a professor, click on the "Edit" link (see Figure 4.75) for that professor. Similarly, to remove a professor from the department, click on the "Remove" link for that professor.

4.3.2.4 Add new professors

To add a professor to the department, click on the "Professors: Add" link on the submenu to get the input form as shown in Figure 4.76. An active professor user can do nothing more except to log in to the system until he/she is assigned a specific system access role. For instance, a professor will not be able to access the course pages until he/she is assigned the "Course Instructor" access role by being assigned to a course.

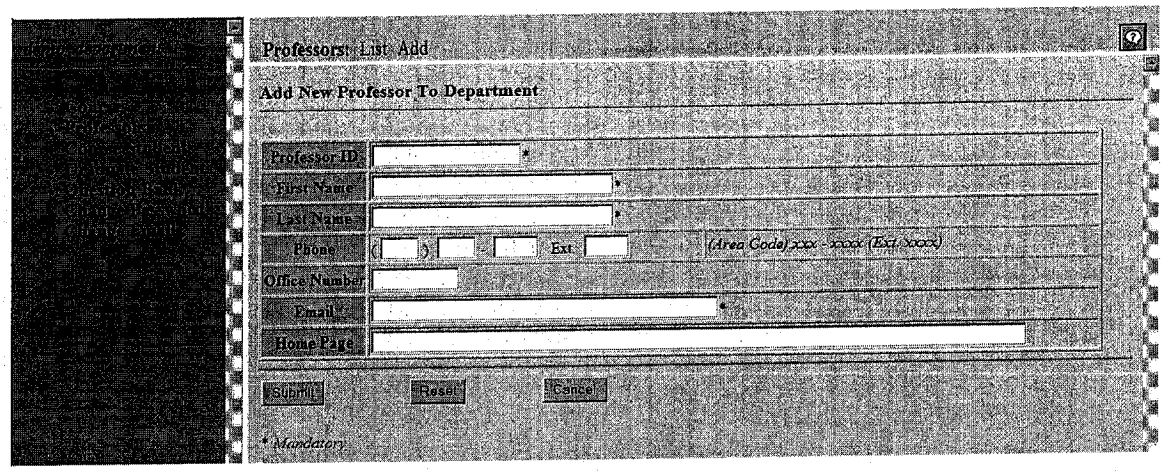


Figure 4.76 Add Professors

4.3.3 Course Students

Click on the "Course Students" link in the left frame of the pages for Department Administrator, the submenus and the overall feature introduction for the "Course Students" menu is displayed (see Figure 4.73).

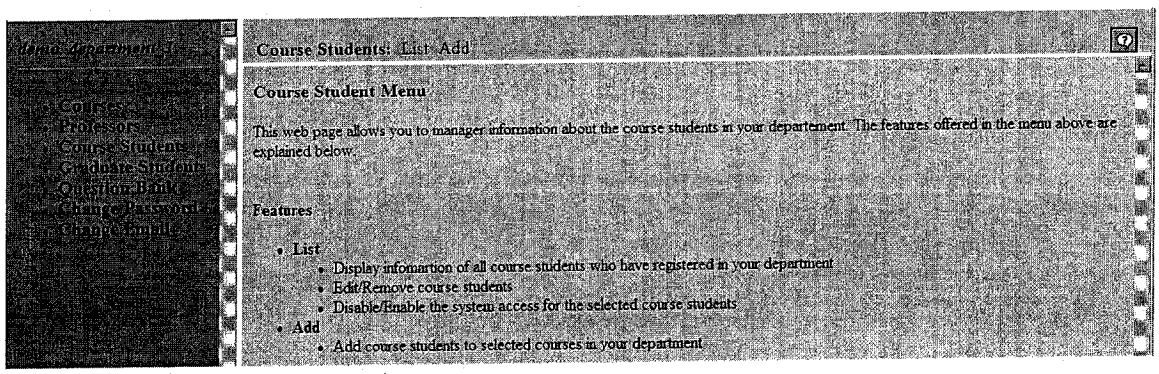


Figure 4.77 Course Students Menu

4.3.3.1 Course student list

Click on the "Course Students: List" link on the submenu and select a desired course section to show the list of existing course students for that course section (see Figure 4.78). To sort the students by the student IDs, click on the "Student ID" table header.

Similarly, click on one of the "First Name", "Last Name", and "User Name" table headers to sort the students in different orders.

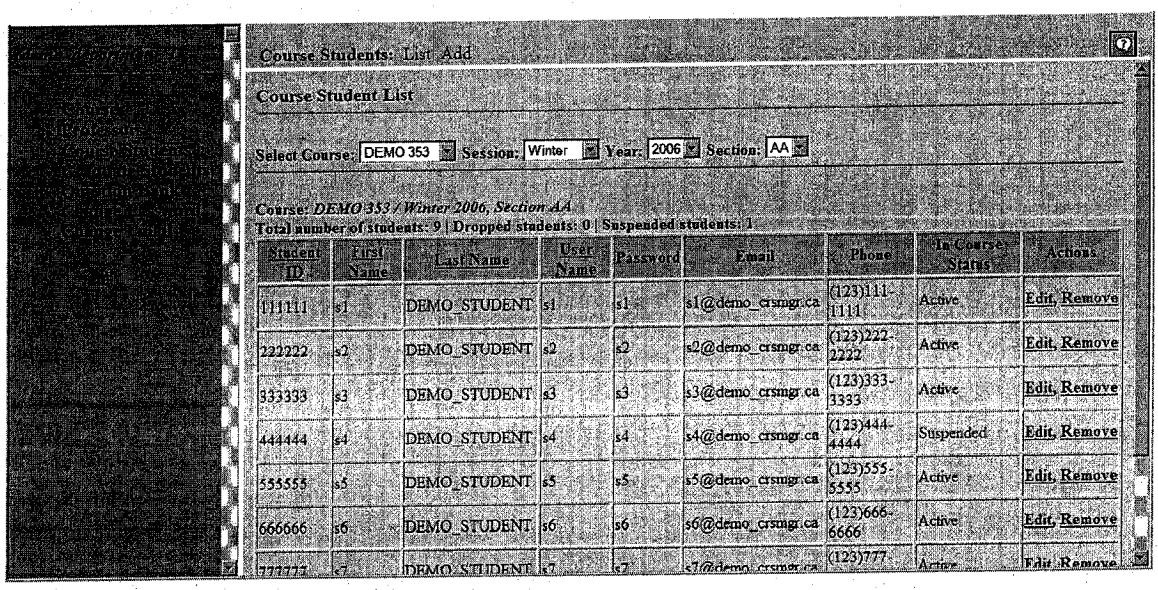


Figure 4.78 Course Student List

4.3.3.2 Edit/remove course students

To edit the information of a course student, click on the "Edit" link (see Figure 4.78) for that student. A course student can be in one of the three statuses: active, suspended, or dropped. A course student who is in suspended or dropped status cannot access the course section. An instructor may suspend a student from accessing the course page temporarily for reasons such as the student's impolite behaviors during the class. When a student is marked as "Dropped", she will be removed from the course group that she joined. Similarly, to remove a student from the course section, click on the "Remove" link for that student. A student that has been referenced in the course is not allowed to be deleted from the course. For example, if a student has uploaded some files for assignments or projects, or has taken some on-line assessment, or has been assigned some course marks, she is considered as being referenced in the course. Figure 4.79 shows the

page for editing a course student.

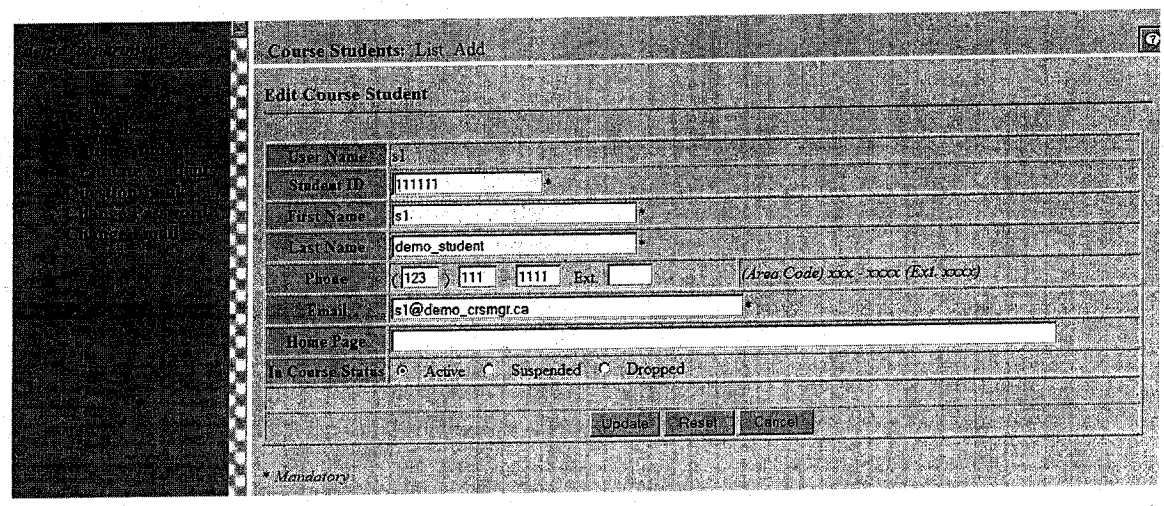


Figure 4.79 Edit Course Student

4.3.3.3 Add course students

To add course students to a selected course section, click on the "Course Students: Add" link on the submenu and choose the desired course section. Two options are offered: insert single student or insert students by file (see Figure 4.80). To insert students one by one manually, click on the "Insert Single Student" button. To insert students by uploading a text file which contains the student list, click on the "Insert Students by File" button.

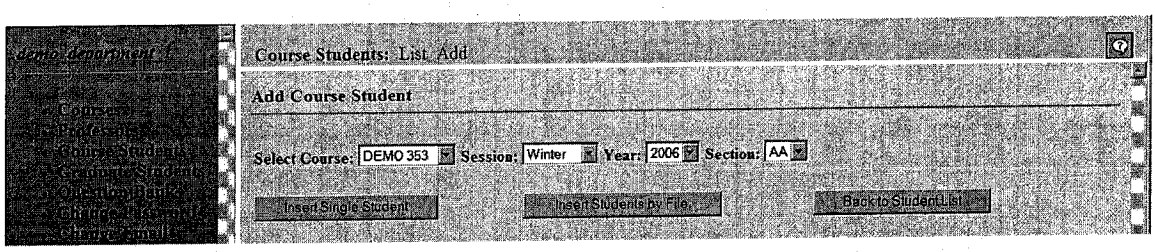


Figure 4.80 Add Course Students

Figure 4.81 shows the page for inserting a single student to a selected course. Once a student is inserted successfully, a system email which contains the student's user account

information will be sent to the student's email address to notify the student.

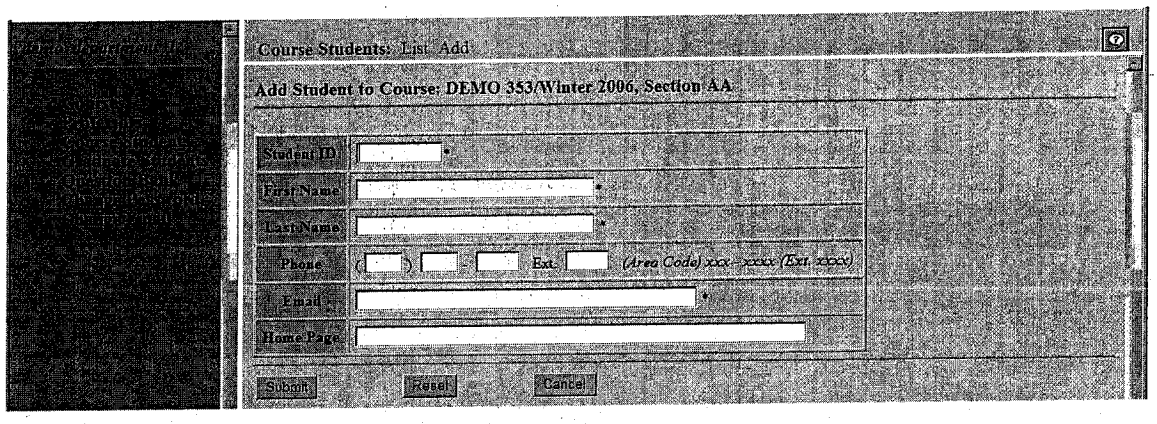


Figure 4.81 Insert a Single Course Student

Figure 4.82 shows the page for inserting students by uploading a file which contains the latest student list for the course. The data for students are delimited by either commas or tabs. The system reads the data file and compares the course student list stored in the file with the current one. Those students that are not yet in the current student list will be inserted, while those already in the current student list will be updated with the latest information except the existing email address. Those existing students that are not in the latest student list will be marked as "Dropped" students. A system email which contains the student's user account information will be sent to the email address for each inserted student.

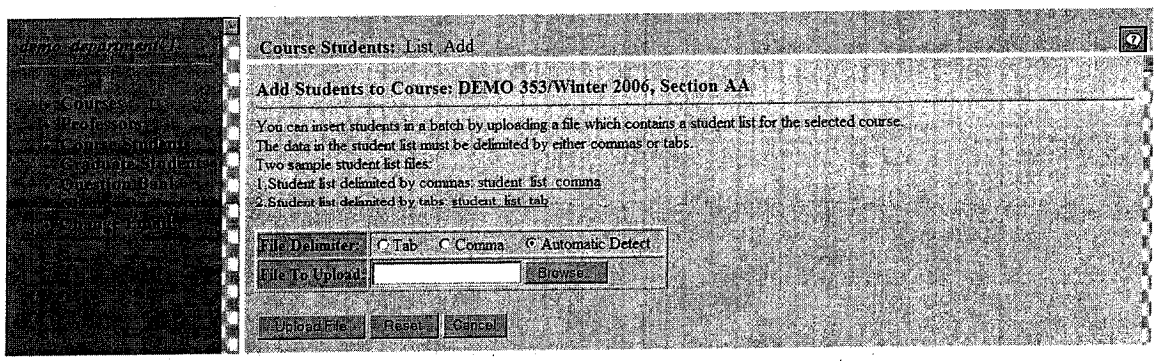


Figure 4.82 Insert Course Students by File

4.3.4 Graduate Students

Click on the "Graduate Students" link in the left frame of the pages for Department Administrator, the submenus and the overall feature introduction for the "Graduate Students" menu is displayed (see Figure 4.83).

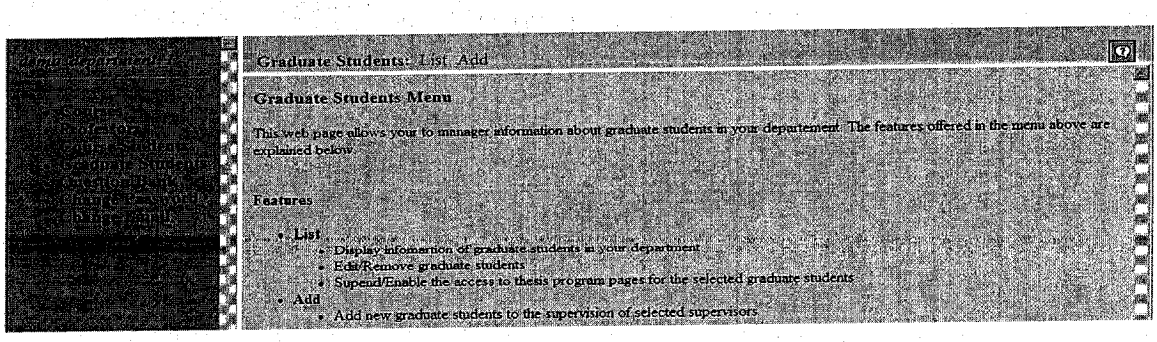


Figure 4.83 Graduate Students Menu

4.3.4.1 List existing graduate students

Click on the "Graduate Students: List" link on the submenu, and then select a desired thesis supervisor to show the list of existing thesis students (see Figure 4.84). To sort the students by the student IDs, click on the "Student ID" table header. Similarly, click on one of the "First Name", "Last Name", and "User Name" table headers to sort the students in different orders.

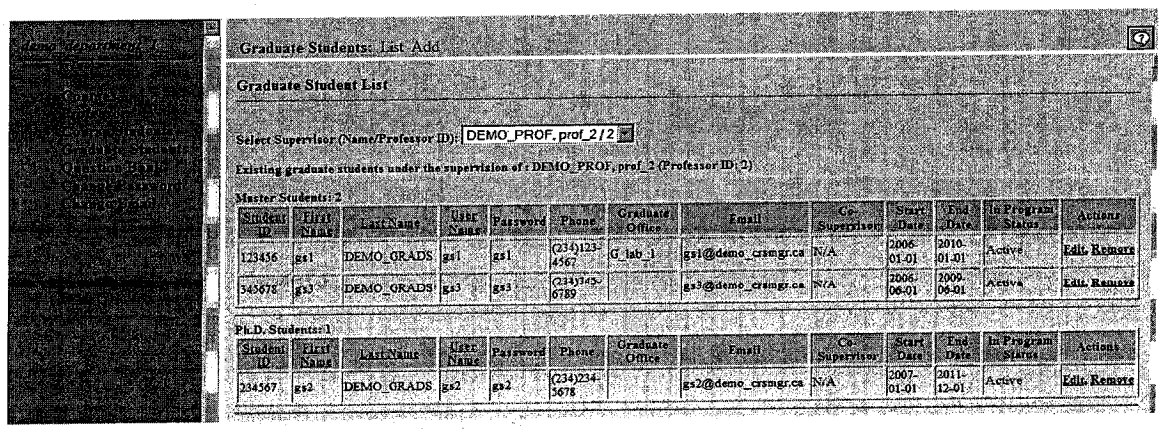


Figure 4.84 Graduate Student List

4.3.4.2 Edit/remove graduate student

To edit the information of a graduate student, click on the "Edit" link (see Figure 4.84) for that student. If the supervisor and/or the graduate student are changed, confirmation emails will be sent to the new supervisor and/or the new graduate student. To remove a graduate student from the supervision of a selected supervisor, click on the "Remove" link for that student. Figure 4.85 shows the page for editing a graduate student.

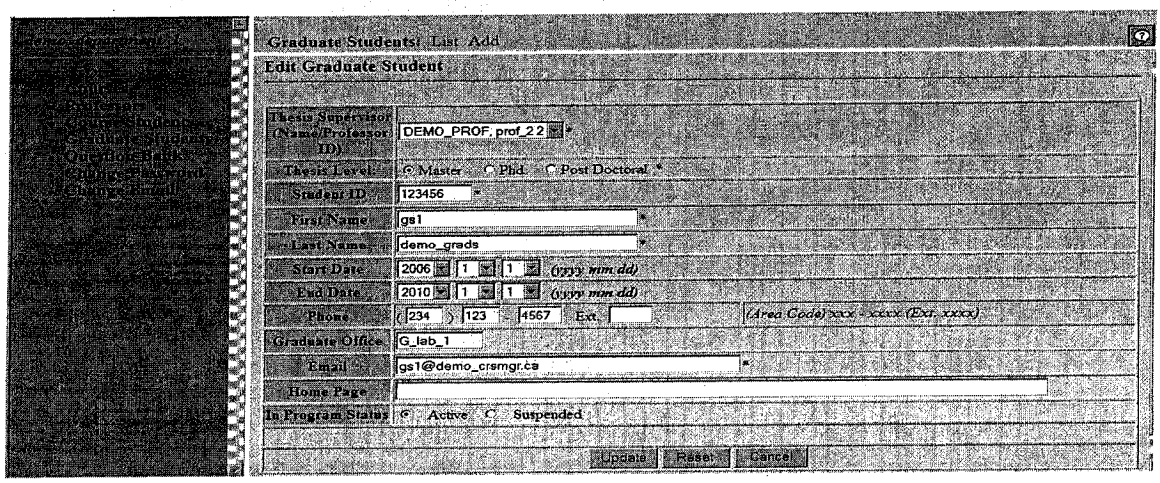


Figure 4.85 Edit Graduates Student

4.3.4.3 Add graduate student

To add a thesis graduate to the supervision of a supervisor, click on the "Graduate Students: Add" link on the submenu. When a new graduate student is added to the supervision of a selected supervisor, system confirmation emails will be sent to both the graduate student and the supervisor. A supervision relationship between a graduate student and a supervisor must be unique for a thesis level. However, a thesis graduate can have more than one supervisor for the same thesis level. When multiple supervision relationships for a same student at the same thesis level are inserted, this student is co-supervised by several supervisors.

4.3.5 Question Bank

This feature has already been discussed in section 4.1.2.

4.3.6 Change Password

This feature is similar as the one for System Administrator, which was discussed in section 4.2.7.

4.4 Course Coordinator

A course coordinator performs the common tasks related to all course sections for a course during the same term if the sections are coordinated. For example, he/she is responsible to create common course materials and has the privilege to access and update the question bank for the course. The features for question bank, course materials, teaching emails, change password, and change email have been discussed in section 4.1.2 to section 4.1.4, section 4.1.1.5 and section 4.1.1.6. The features for course sections, course instructors, and course students are similar as the ones for Department Administrator, which are discussed in section 4.3.1 to section 4.3.3.

4.5 Course Instructor

A course instructor performs the detailed tasks for his/her own course section. For example, he/she is responsible to create and manage course project groups, set up the tutorial/lab time slots, and send teaching emails to the students. Please recall that a course section can be either coordinated or self-managed; the difference between a coordinated section and a self-managed section has been discussed in section 4.3.1.8. The features for question bank, teaching emails, and changing email have been discussed in

section 4.1.2, section 4.1.4, and section 4.1.1.6. The features for session information, course students, and change password are similar as the ones for the Department Administrator, which are discussed in the section 4.3.1, section 4.3.3, and section 4.3.6.

4.5.1 Course Groups

If group work is required in a course, the Course Instructor is responsible to set up and control the course groups in his own course section.

4.5.3.1 Set up course group parameters

Before creating the groups, the Course Instructor is required to set up three group parameters by clicking on the "Course Groups" link in the left frame of the pages for the Course Instructor. These parameters are the group member capacity, the deadline for joining group, and the deadline for electing the group leaders (see Figure 4.90). The system will generate enough empty course groups based on the enrollment of students in course and the specified group size. Each student is required to join one of the groups before the join group deadline. After this deadline, the students who are still not in a group will be assigned randomly to one of the groups that are not full. Moreover, each group is required to choose a group leader by voting before the leader election deadline. The leader of a group is responsible for coordinating the members to complete their work by the deadline(s). After the election deadline, the system will assign a leader for each group either according to the votes given by the members or randomly if no group member participated in the election.

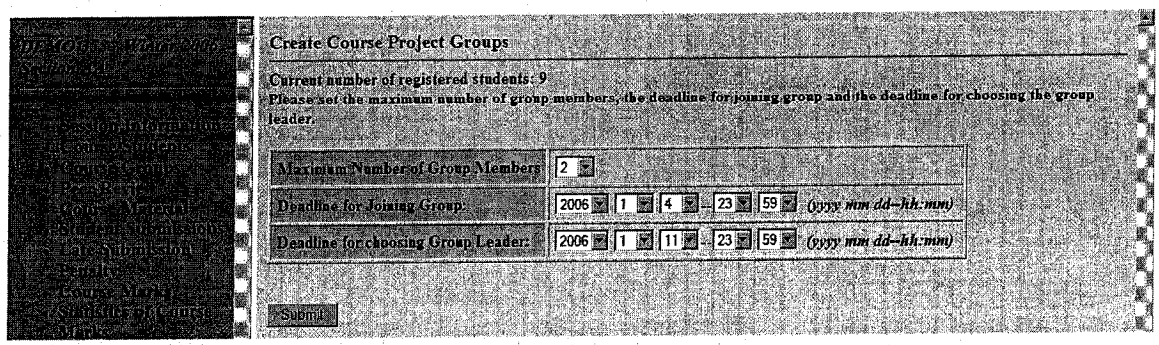


Figure 4.86 Set Up Course Group Parameters

4.5.3.2 Course group list

Once the course group parameters have been set up, the system will generate a number of empty course groups waiting for the students to join (see Figure 4.91).

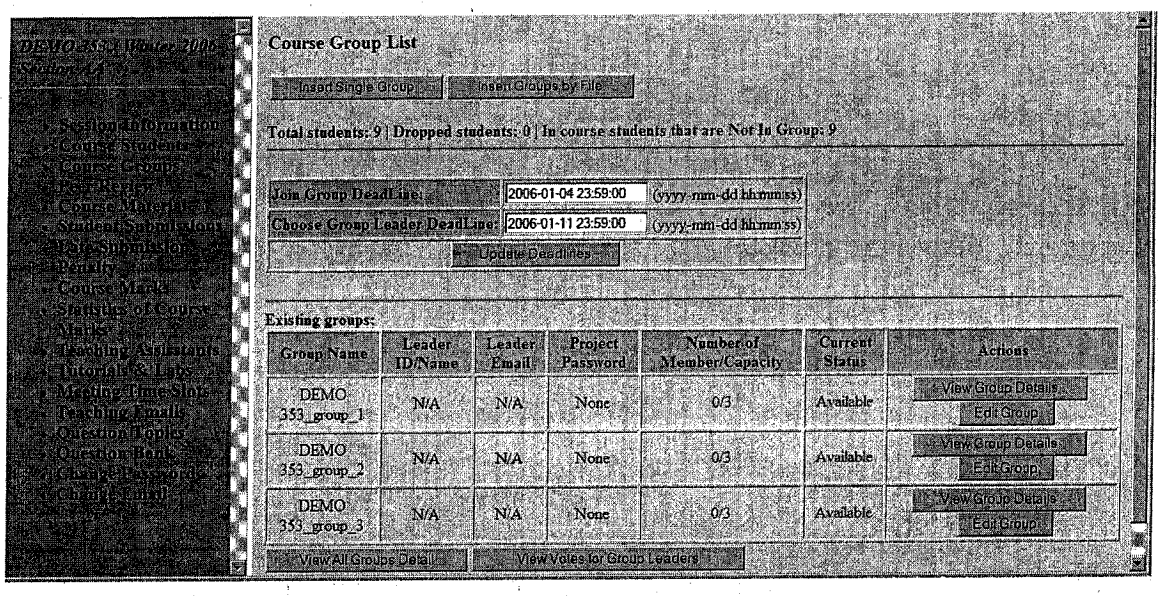


Figure 4.87 Course Group List

4.5.3.3 Update deadlines for joining group and choosing group leaders

The course instructors might need to update the deadlines for joining group and choosing group leaders. To update the deadlines, make changes to the deadlines and press the "Update Deadlines" button shown in Figure 4.87.

4.5.3.4 Create new course groups

Although a number of course groups are generated initially by the system, the course instructors might need to create more new course groups if required. There are two options for the instructors: create a single group at a time or create groups by file. To insert a single group manually, click on the "Insert Single Group" button (see Figure 4.87). To insert course groups in a batch by uploading a text file which contains the group data, click on the "Insert Groups by File" button (see Figure 4.87).

Figure 4.88 shows the web page for inserting a single course group. A group name is suggested according to the existing course group names. However, the instructor can change it. A new group can be created with or without group members; the students that are not yet in group are shown. The instructor can choose some of them to add to the new group and assign one of these group members as the group leader.

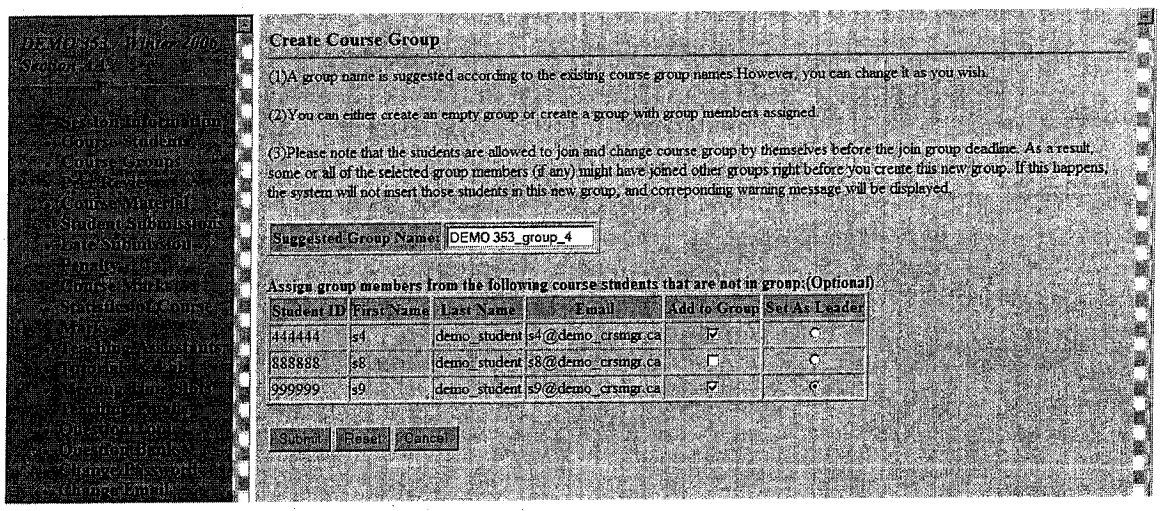


Figure 4.88 Insert Single Course Group

Figure 4.89 shows the page for inserting course groups by uploading a file. The file contains the data for the students to be inserted and the data is in the specified format.

When a new group is created with a group leader assigned, a system email will be sent to the new group leader.

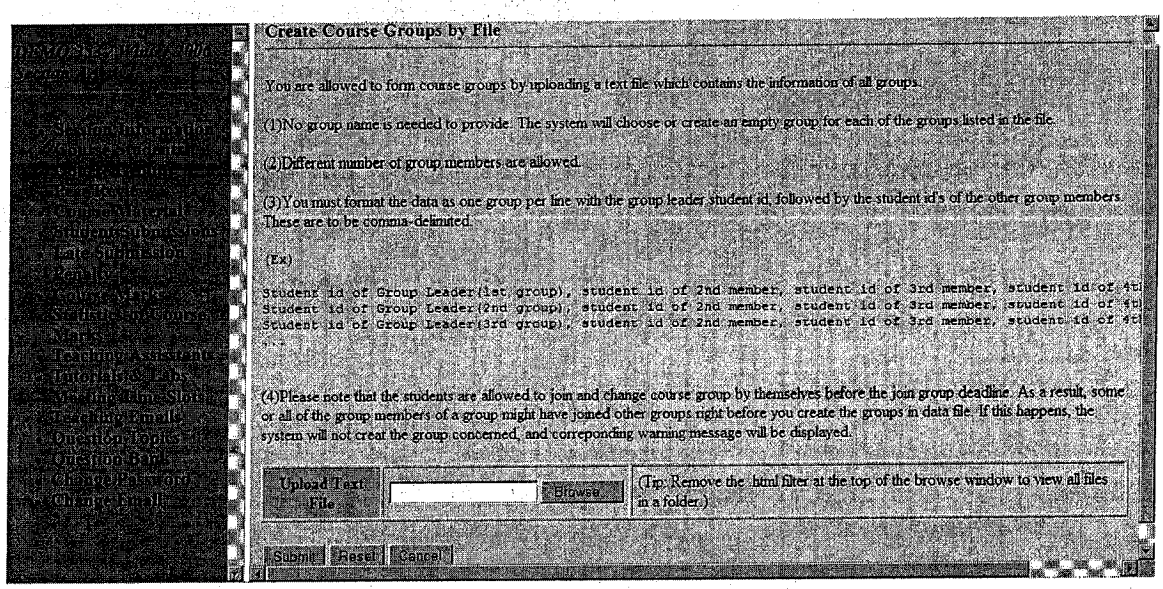


Figure 4.89 Insert Course Groups by File

4.5.3.5 View course group details

To view the detail information for a course group, click on the "View Group Details" button shown in Figure 4.87. A new window will be opened to show the group details (see Figure 4.90). A course group could be in one of these three statuses: Available, Full, or Locked. A group marked as "Available" can be joined by the students. However, its capacity might be filled by other students before a student's join group request is made to the CrsMgr. A group marked as "Full" cannot be joined. However, some of its members might choose to drop/change group at anytime before the deadline. A group marked as "Locked" cannot be joined since its current members choose to lock their group even though the number of group member is less than the maximum size. However, the members of a "Locked" group could "Unlock" the group later.

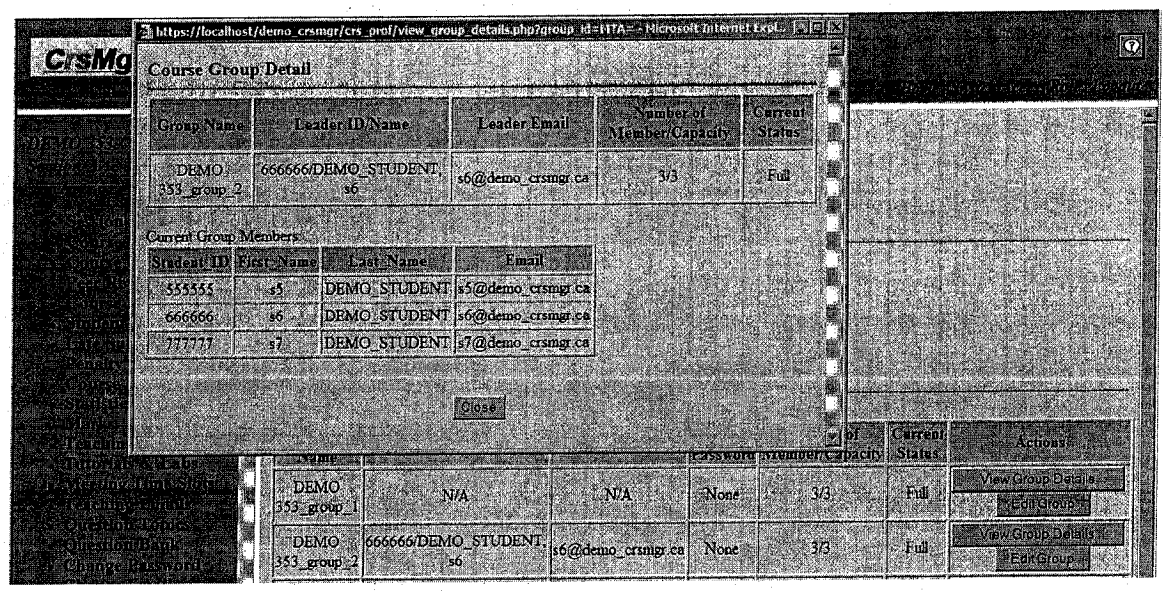


Figure 4.90 Course Group Details

4.5.3.6 Edit course groups

To edit an existing course group, click on the "Edit Group" button shown in Figure 4.87. The detail information of the group together with a couple of links that lead to different operations is displayed (see Figure 4.91).

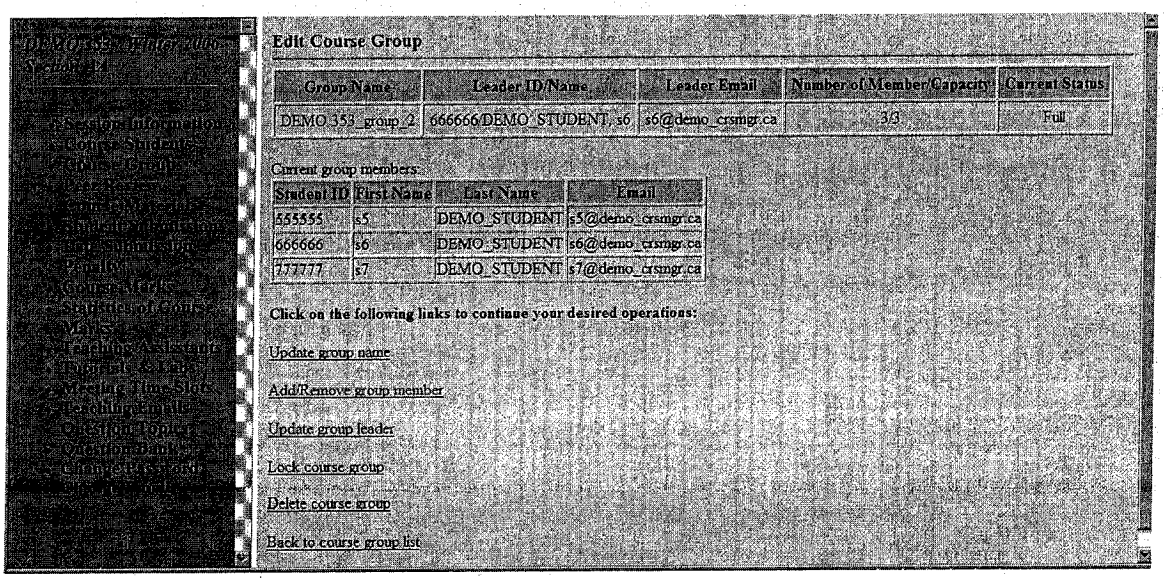


Figure 4.91 Edit Course Group

4.5.3.6.1 Update group name

To change the group name of a group, click on the "Update group name" link shown in Figure 4.91. The group name must be unique within a course.

4.5.3.6.2 Add / remove group members

To add and/or remove members to/from a group, click on the "Add/Remove group member" link shown in Figure 4.91. Both the current group members and the students that are not yet in any group are listed. The instructor can remove current members and to assign new members at the same time (see Figure 4.92). A system email will be sent to each new group member for confirmation purpose.

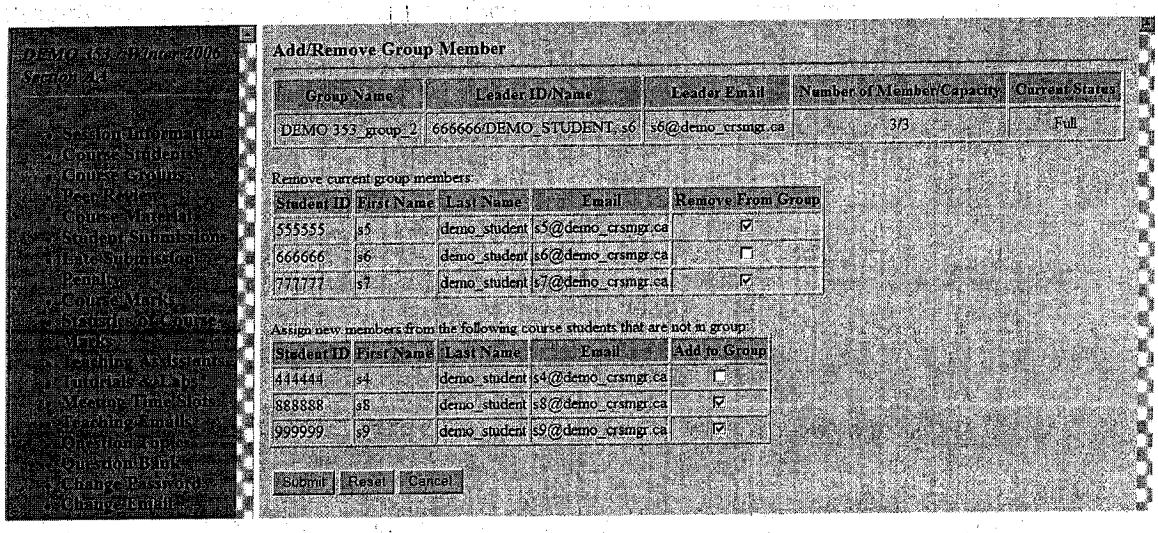


Figure 4.92 Add/Remove Group Members

4.5.3.6.3 Update group leader

To update the group leader of a course group, click on the "Update group leader" link shown in Figure 4.91. The instructor can assign a new group leader among the current group members or just disable the current group leader (see Figure 4.93). If a new group leader is assigned, a system email will be sent to the new group leader.

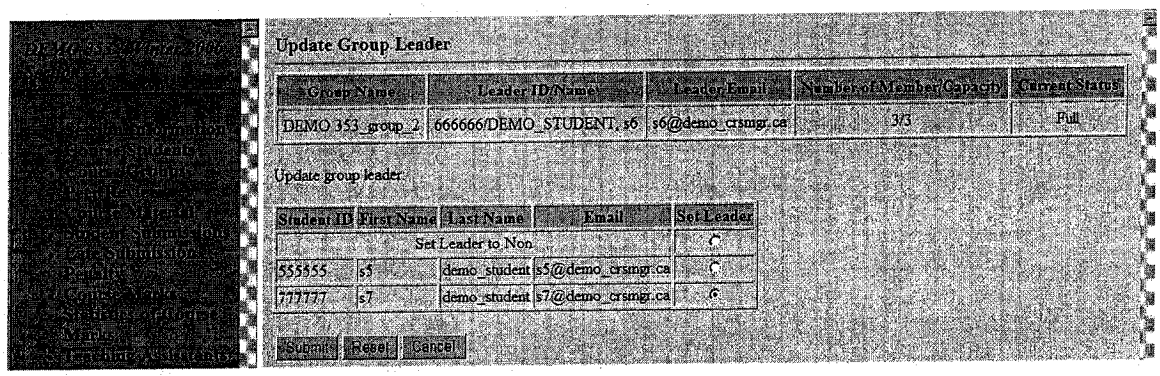


Figure 4.93 Update Group Leader

4.5.3.6.4 Lock/unlock course group

To lock a course group, click on the "Lock course group" link shown in Figure 4.91. Similarly, to unlock a course group that is locked, the instructor could click on the "Unlock course group" link.

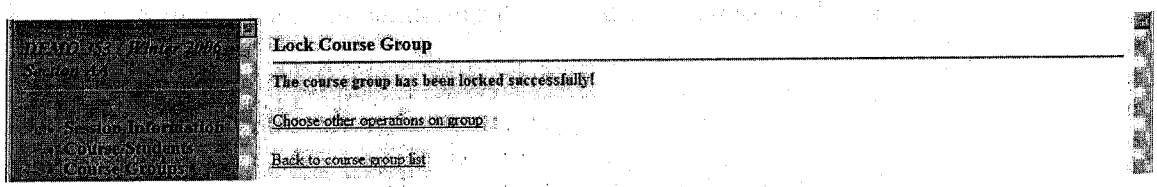


Figure 4.94 Lock Course Group

4.5.3.6.5 Remove course group

To delete a course group, click on the "Delete course group" link shown in Figure 4.91. To remove a course group that is not empty, the instructor should remove the group members first.

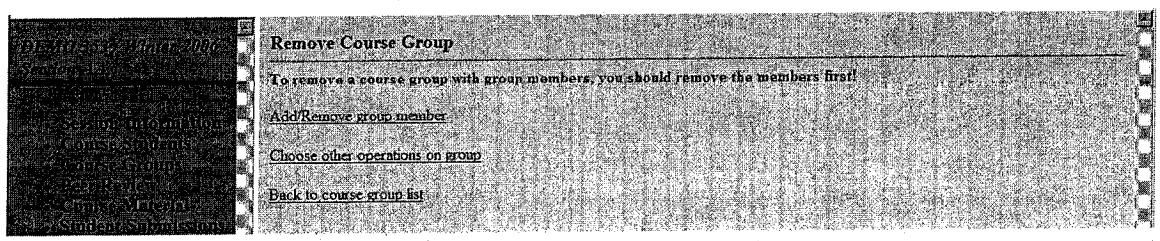


Figure 4.95 Remove Course Group

4.5.3.7 View details of all course groups

Click on the "View All Groups Detail" button shown in Figure 4.87; the detail information of all course groups is displayed (see Figure 4.96).

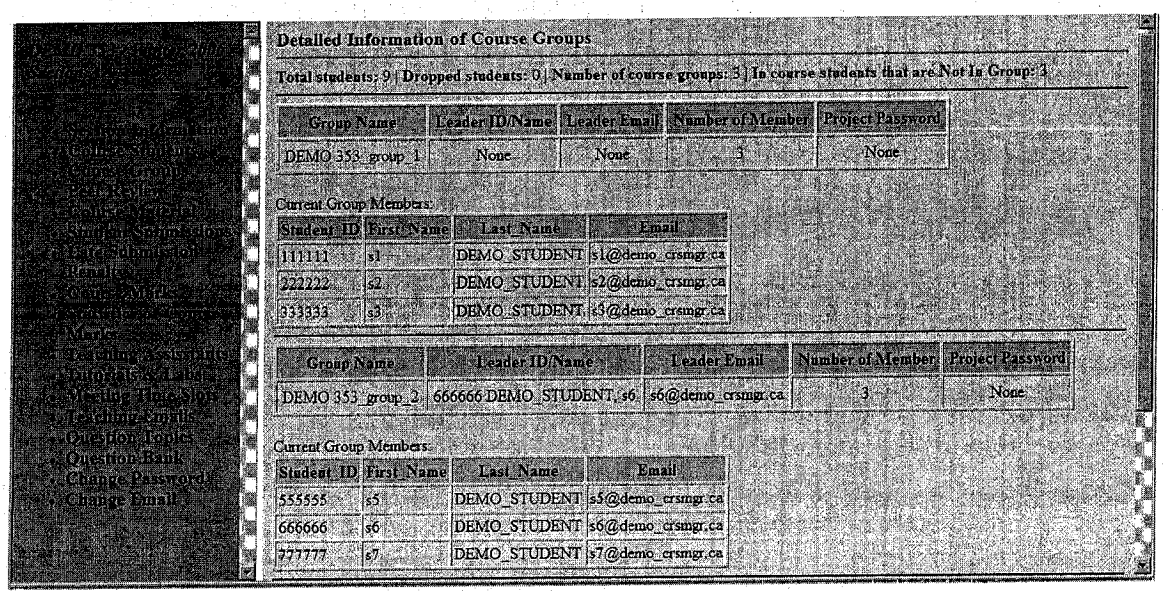


Figure 4.96 Details of All Course Groups

4.5.3.8 View votes for group leaders

Initially, there are no leaders for any group. Students in each group are required to vote for their group leader. Click on the "View Votes for Group Leaders" button shown in Figure 4.87; the detail information on leader votes for all course groups is displayed (see Figure 4.97). After the deadline for voting group leader, the system will assign group leader for each group either according to the votes given by the group members or randomly if no group member participated in the vote. The algorithm for the group leader vote has been discussed in section 3.4.4.

4.5.3.9 Assign group randomly

After the deadline for joining course group, if some students are still not in a group, an

"Assign Group Randomly" button will be displayed. The instructor can assign such students randomly to any group that is not full and not locked by clicking on this button (see Figure 4.98).

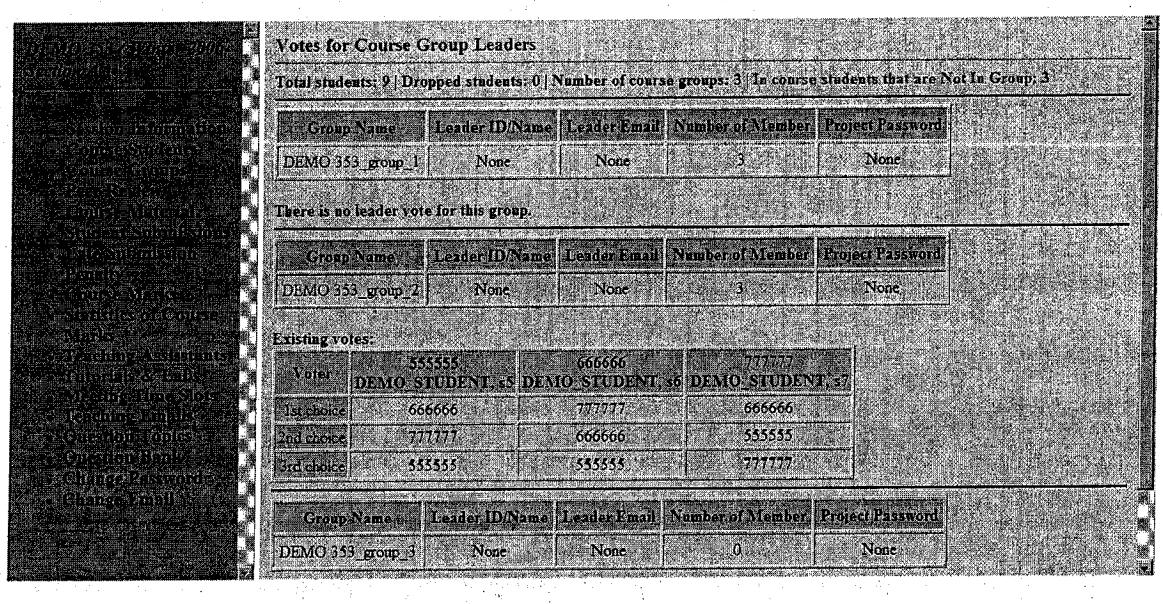


Figure 4.97 Votes for Course Group Leaders

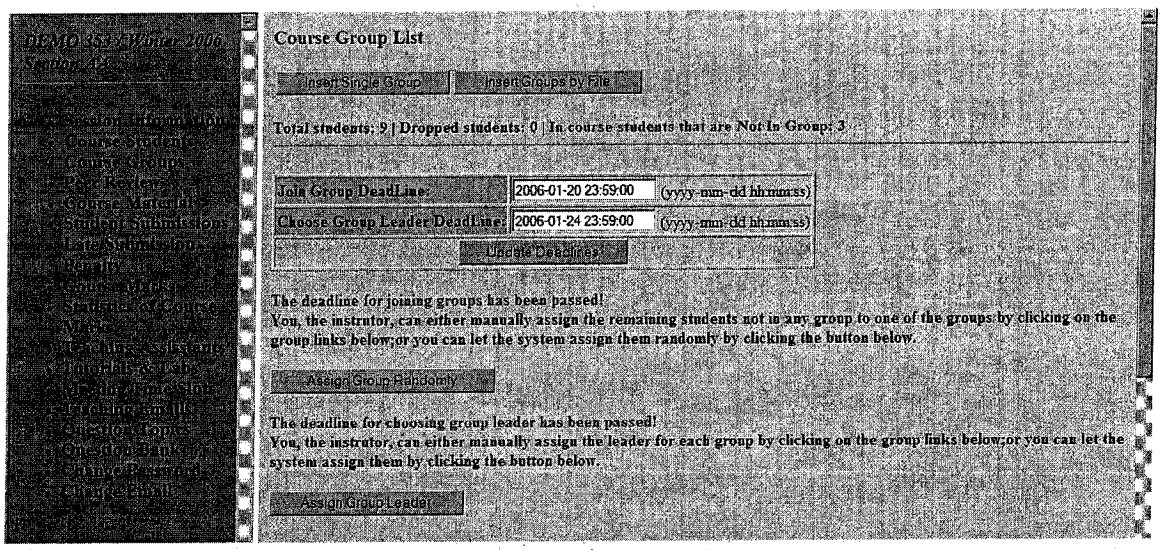


Figure 4.98 Assign group randomly

4.5.3.10 Assign group leader

After the deadline for choosing group leaders, if some groups still have no leader, an

"Assign Group Leader" button will be displayed. The instructor can assign group leaders to such groups by clicking on this button (see Figure 4.98). If the group members have participated in the leader vote, the system will assign the leader according to the votes. Otherwise, the group leader will be chosen randomly among the group members.

4.5.3.11 Send group information

If all students are in group and each group has a group leader, the system will allow the instructor to send the detail information of all course groups to selected email address (see Figure 4.99).

4.5.3.12 Generate project passwords for groups

If all students are in group and each group has a group leader, the system will allow the instructor to generate project passwords for all groups by clicking on the "Generate Project Passwords for Groups" button (see Figure 4.99).

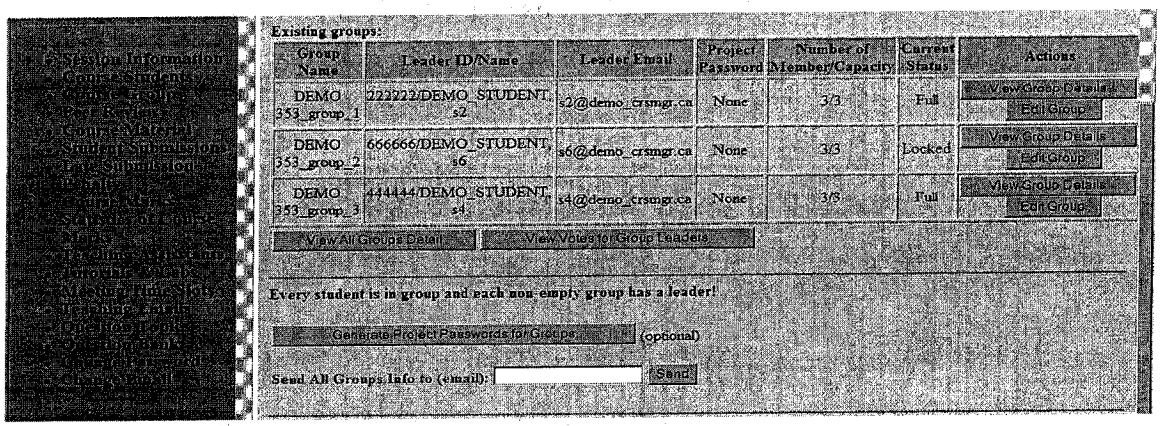


Figure 4.99 Send Group Information

4.5.2 Peer Review

Click on the "Peer Review" link in the left frame of the pages for the Course Instructor; the current setting for the peer review is displayed (see Figure 4.100). If group work is

required in the course, the instructor may require the students to grade the relative contribution of each member for the group work. There are 3 options for peer review setting: (1) No peer review (the default setting); (2) Single peer review at the end of the term; (3) Peer reviews for each group assignment/project.

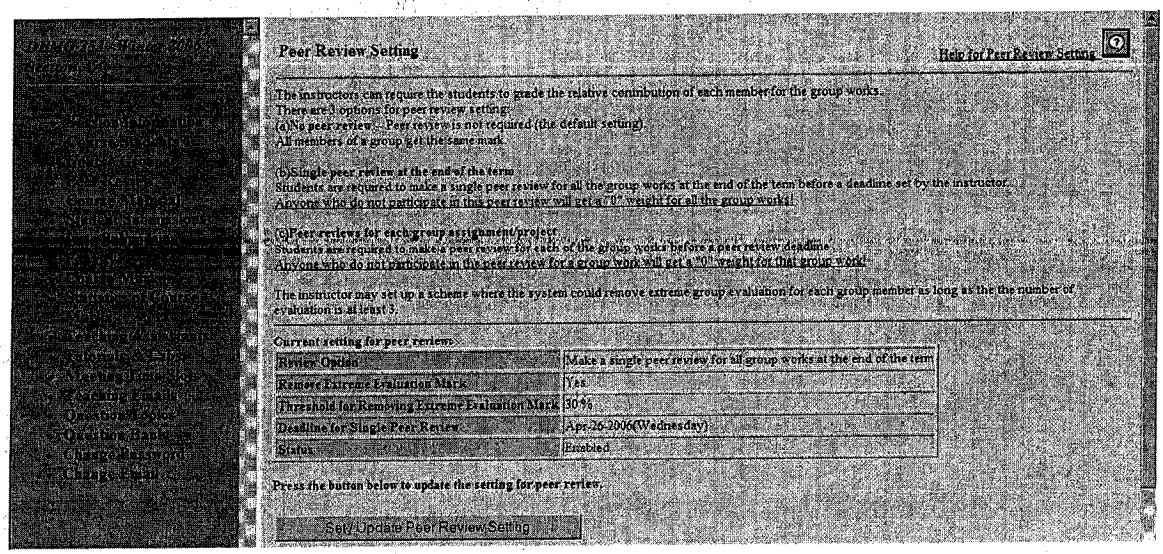


Figure 4.100 Peer Review Setting

4.5.4.1 Set peer review

Initially, there is no peer review setting. To make a peer review setting for the course, click on the "Set/Update Peer Review Setting" button shown in Figure 4.100. There are two steps to create a peer review setting. In step 1, the peer review option is chosen (see Figure 4.101). In step 2, the parameters for the chosen option are set up.

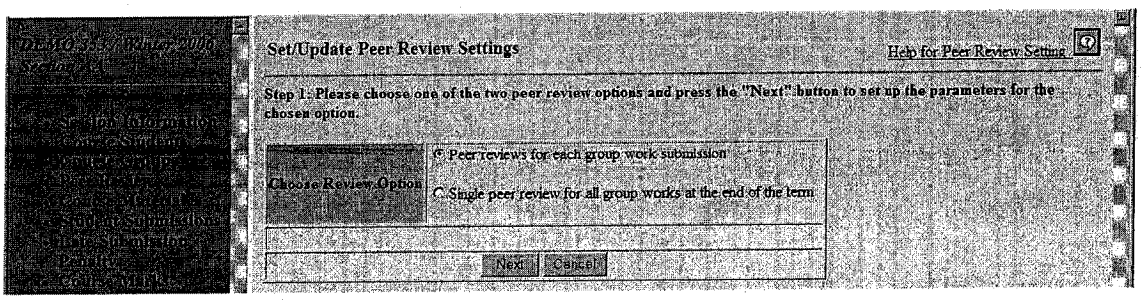


Figure 4.101 Set Peer Review – Choose Review Option

4.5.4.1.1 Set peer review parameters -- single peer review

The instructor could require students to make a single peer review for all group activities at the end of the term. Anyone who does not participate in the peer review will get a "0" final weight. In this review option, the instructor must specify a deadline for the peer review. Also, the instructor could specify whether to ignore the extreme evaluation scores. The detail explanation on the parameters is listed on the web page shown in Figure 4.102.

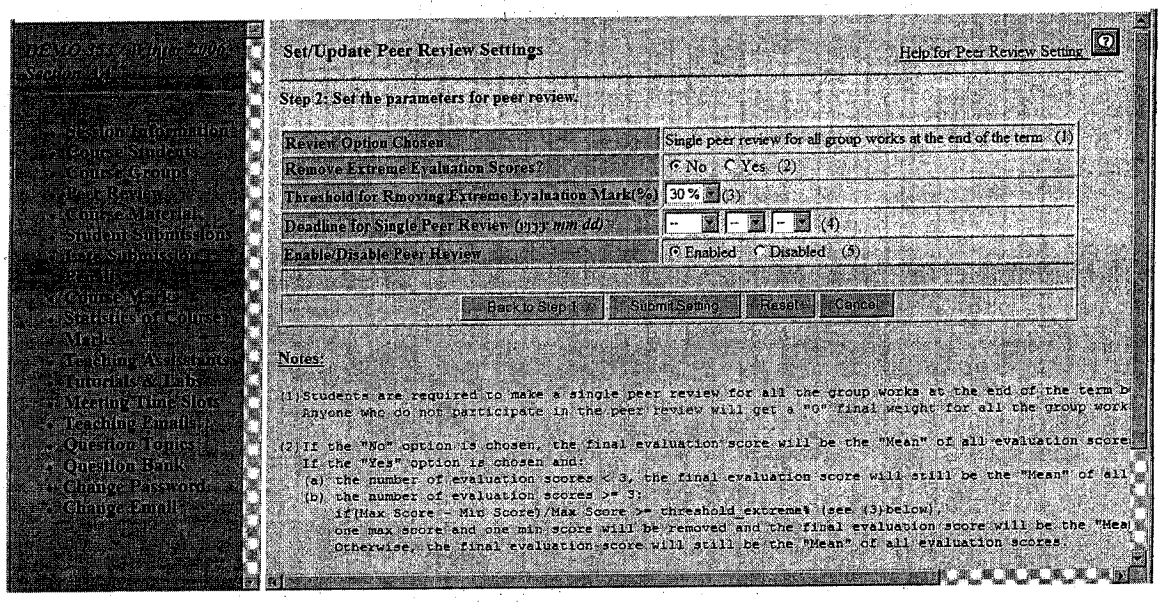


Figure 4.102 Set Peer Review Parameters – Single Peer Review

4.5.4.1.2 Set peer review parameters -- peer reviews for each group work

The instructor could require students to make a peer review for each group work before a deadline. The peer review deadline for a group work is calculated by the system according to the due date of the group work and the late submission penalty rate, which are set by the instructor. Anyone who does not participate in the peer review for a group work will get a "0" final weight for that group work. In this review option, the instructor could specify whether to discard the extreme evaluation scores and when to show the

peer review scores to the students. The detail explanation on the parameters is listed on the web page shown in Figure 4.103.

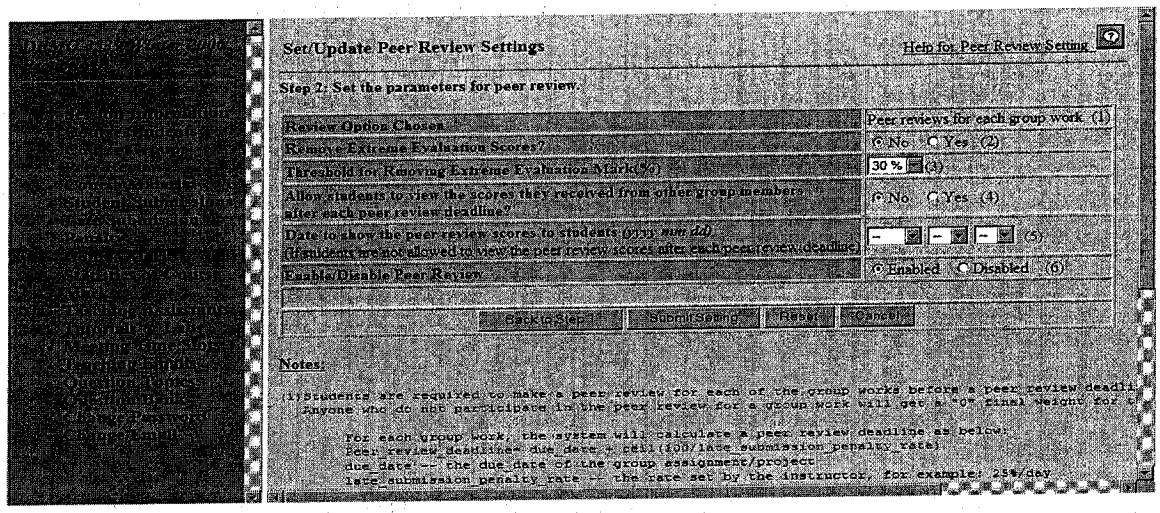


Figure 4.103 Set Peer Review Parameters – Peer Reviews for Each Group Work

4.5.4.2 Update peer review setting

To make change to a peer review setting for the course, click on the "Set/Update Peer Review Setting" button shown in Figure 4.100. Figure 4.104 shows the page for updating the setting for single peer review. The instructor is also allowed to change the peer review option by clicking on the "Change Review Option" button.

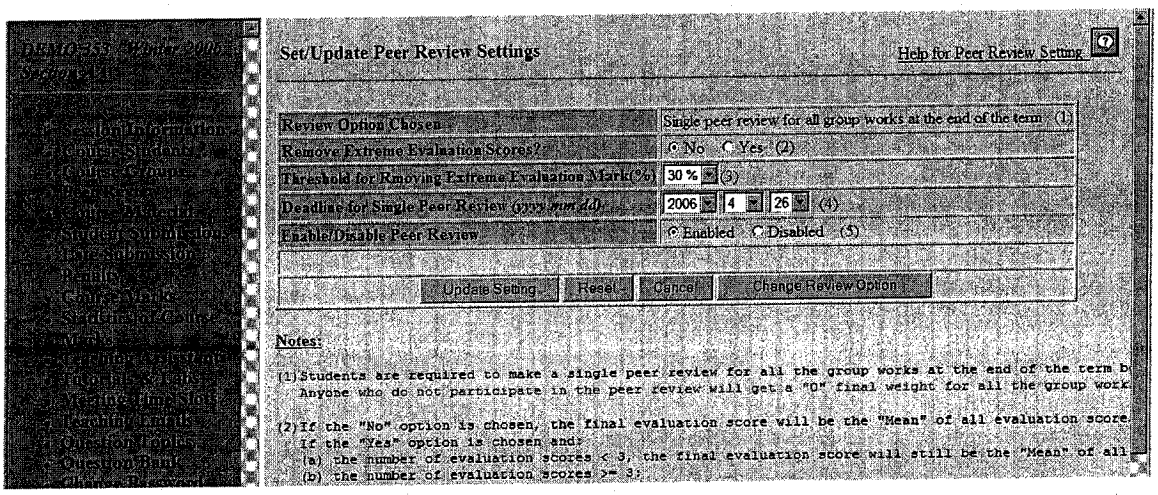


Figure 4.104 Update Peer Review – Single Peer Review

4.5.4.3 Show peer review information – single peer review

If the current peer review setting is single peer review option, a "Show Peer Review Info" button will appear on the bottom of the page (see Figure 4.105). Click on this button; the detail information for the single peer review will be displayed (see Figure 4.106). The peer review scores are listed for each student and are ordered by groups. Click on a peer review score; a pop-up window will be opened to show the reviewer's information as well as the comment. If the "Remove Extreme" option has been chosen, the final peer review score will be calculated with extreme values discarded. If none of the group members evaluated a student, this student will get '100' as his/her final peer review score. However, any student who did not participate in the peer review will get '0' weights for all the group works no matter what final peer review score he/she gets.

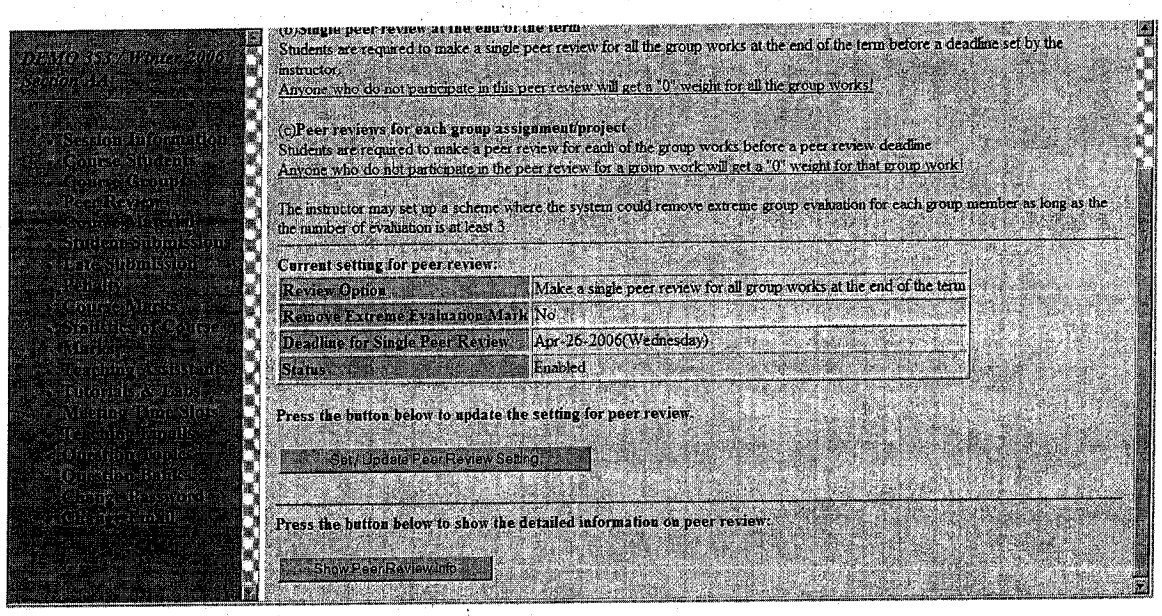


Figure 4.105 the "Show Peer Review Info" Button

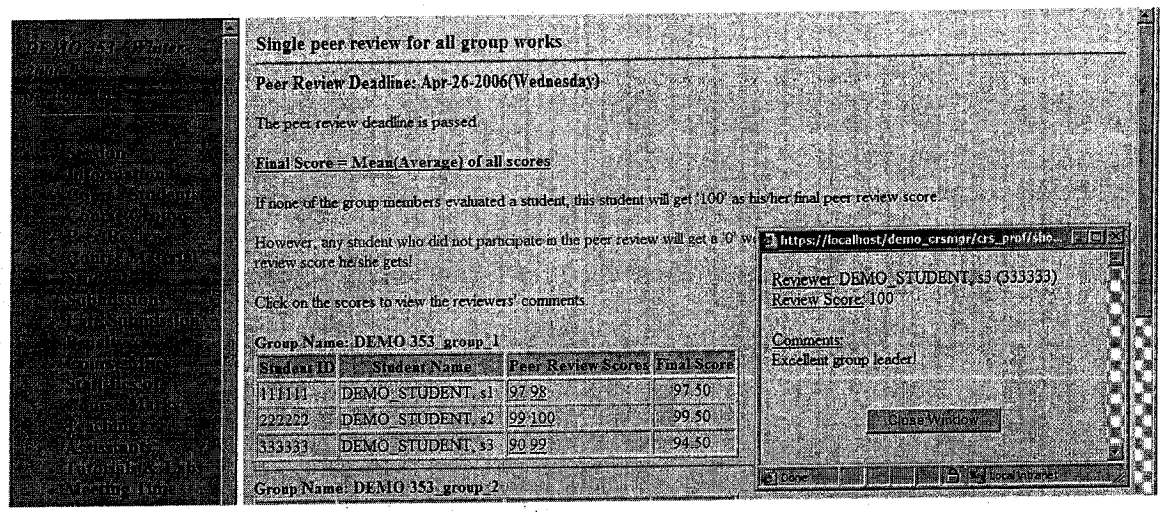


Figure 4.106 Detail Peer Review Information – Single Peer Review

4.5.4.4 Show peer review information – one peer review for each group work

If the current peer review setting is to make one peer review for each group work, all group works will be listed with their due dates and peer review deadlines (see Figure 4.107). Click on the title link for a group work; the peer review information for this group work will be displayed (see Figure 4.108).

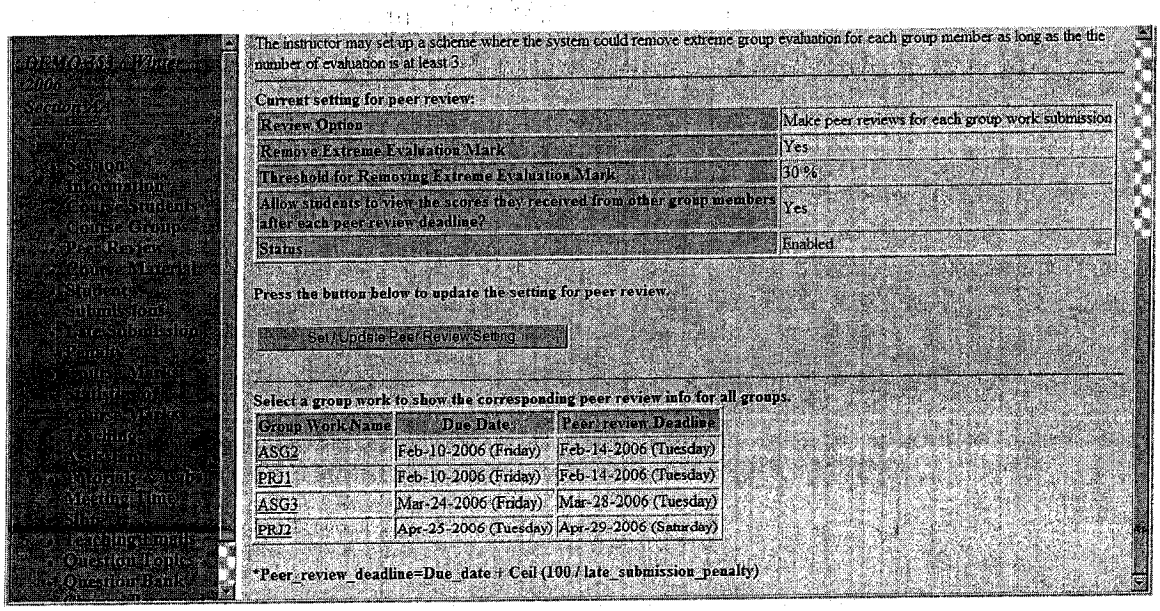


Figure 4.107 Peer Review Links – One Peer Review for Each Group Work

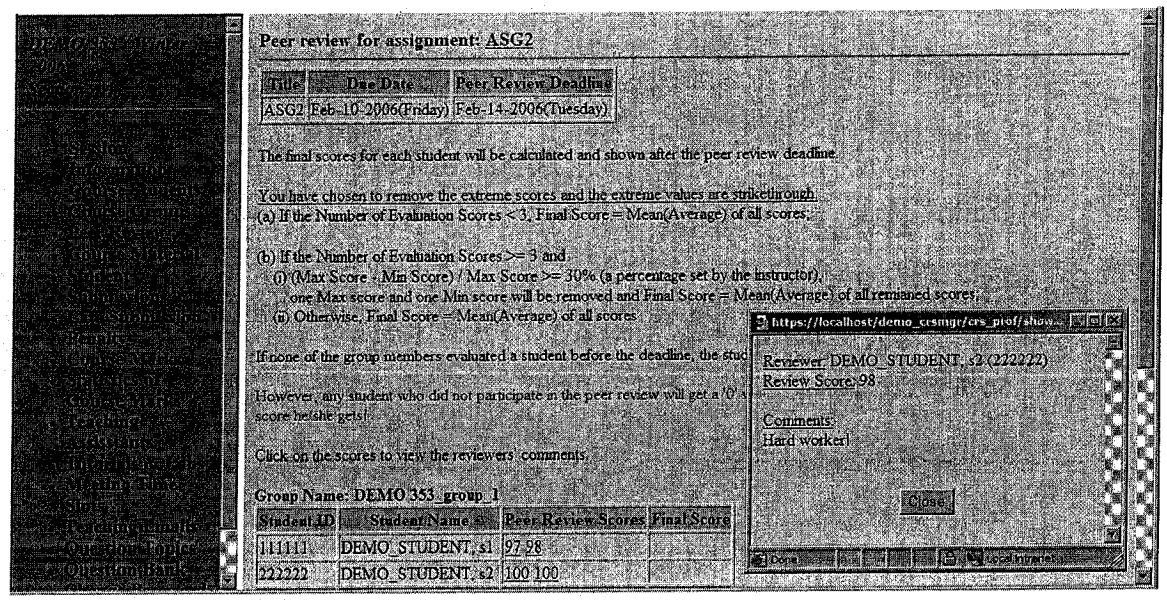


Figure 4.108 Detail Peer Review Information – One Peer Review for Each Group Work

Existing peer review scores are listed and are ordered by groups. Click on a peer review score; a pop-up window will be opened to show the reviewer's information as well as the comment. If the "Remove Extreme" option has been chosen, the final peer review score will be calculated with extreme values discarded. If none of the group members evaluated a student, this student will get '100' as his/her final peer review score. However, any student who did not participate in the peer review will get a '0' weight for this group work no matter what final peer review score he or she gets.

4.5.3 Course Material

Most of the features about course material have been discussed in section 4.1.3 except the one for setting up special arrangements for an assessment.

Normally all course students are required to take an assessment during a preset time window and are given the same amount of time to finish the assessment. However, for those students with special needs, the instructor could set up a special time window and a

longer duration. Click on the "Special Arrangement" link for an assessment (see Figure 4.109); the page that lists the existing special arrangements will be displayed (see Figure 4.110).

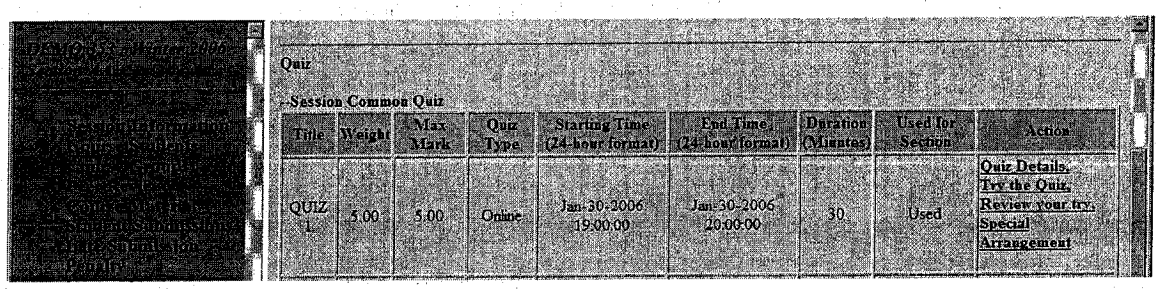


Figure 4.109 Link for the Special Arrangement for an Assessment

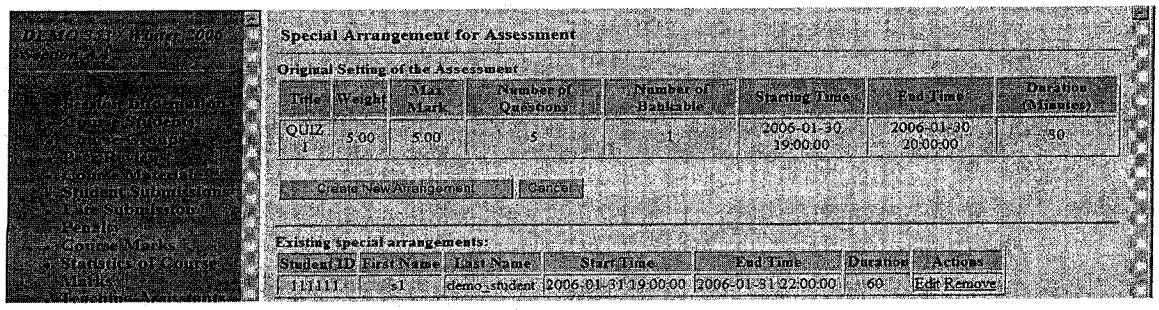


Figure 4.110 List of the Special Arrangements for an Assessment

To create a special arrangement, click on the "Create New Arrangement" button (see Figure 4.110). To edit or remove an existing special arrangement, click on the "Edit" or "Remove" link for that arrangement. Figure 4.111 shows the page for creating a new special arrangement.

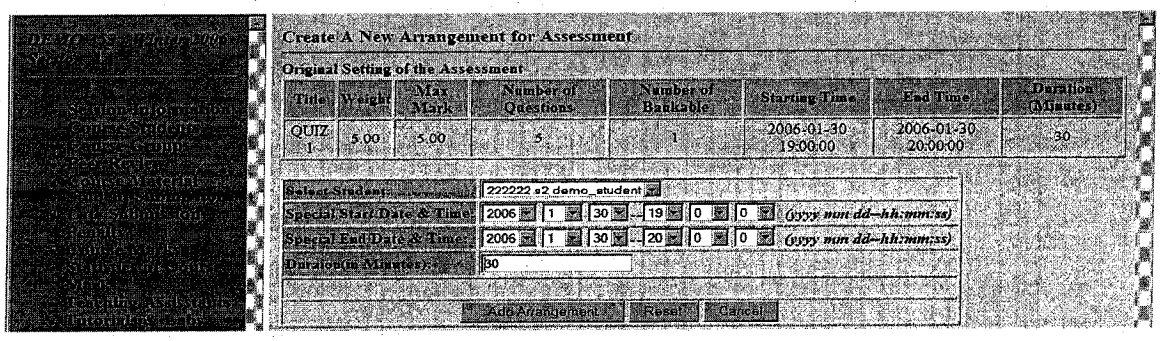


Figure 4.111 Create New Special Arrangements for an Assessment

4.5.4 Student Submissions

In the left frame of the pages for the Course Instructor, a "Student Submissions" link is provided to group together the functionality required for managing the student submissions for assignments and projects.

4.5.6.1 Summary for student submissions

Click on the "Student Submissions" link; the summary for all the student submissions is displayed (see Figure 4.116). If student submissions for an assignment or project exist, a "Read Uploaded Files" link will appear to allow the instructor to read/download the student submissions. Likewise, after the due date for an assignment or project, if some students still have not yet submitted their works, an "Upload Late Submission" link is provided to allow the instructor to upload the late submissions when it is justified. Late penalty will be applied to the late submission.

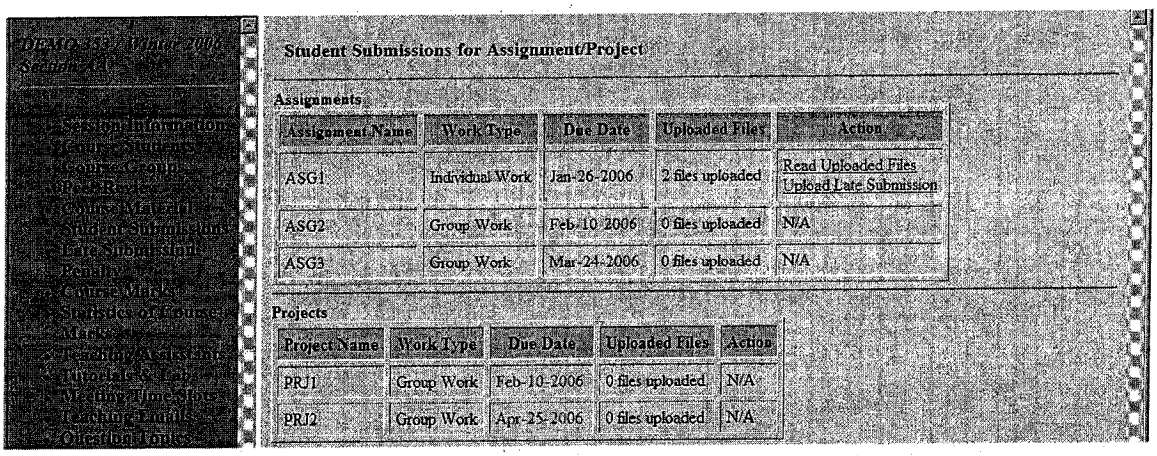


Figure 4.112 Summaries for Student Submissions

4.5.6.2 Read/download student submissions

Click on the "Read Uploaded Files" link for an assignment shown in Figure 4.112; all the student submissions as well as their upload timestamp are listed (see Figure 4.113).The

instructor can then download these submission files.

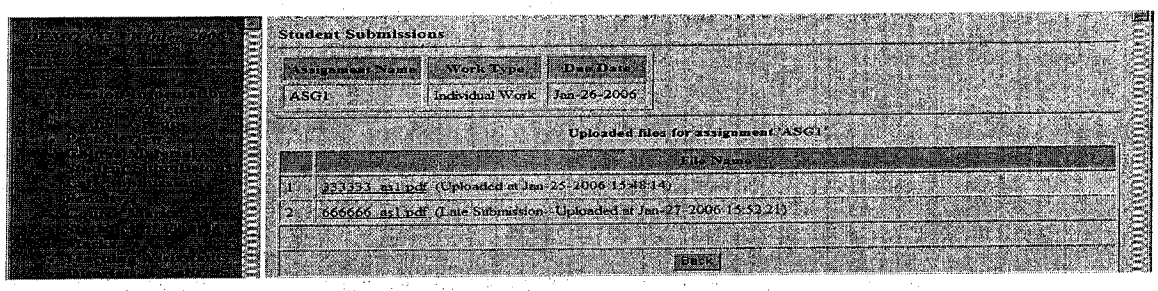


Figure 4.113 Read/Download Student Submissions

4.5.6.3 Upload student late submissions

To upload the student late submissions, click on the "Upload Late Submission" link shown in Figure 4.116. There are two steps to upload a late submission. In step 1, the instructor chooses the student (for an individual work) or the group (for a group work) for whom the late submission is to be uploaded (see Figure 4.114). In step 2, the late submission file is to be uploaded (see Figure 4.115).

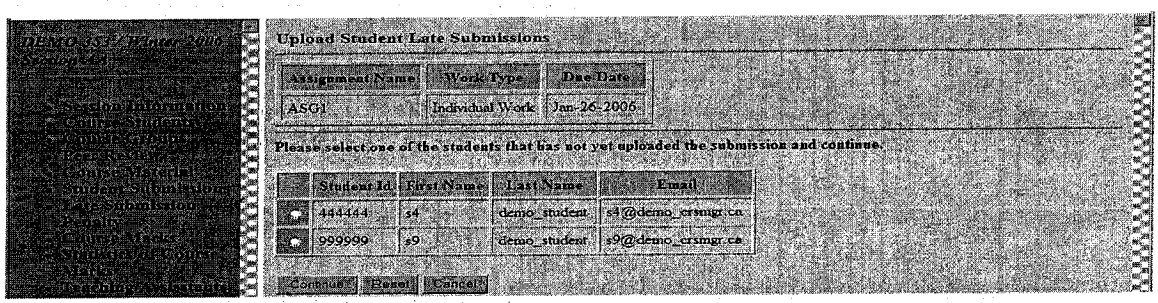


Figure 4.114 Upload Late Submissions – Step 1

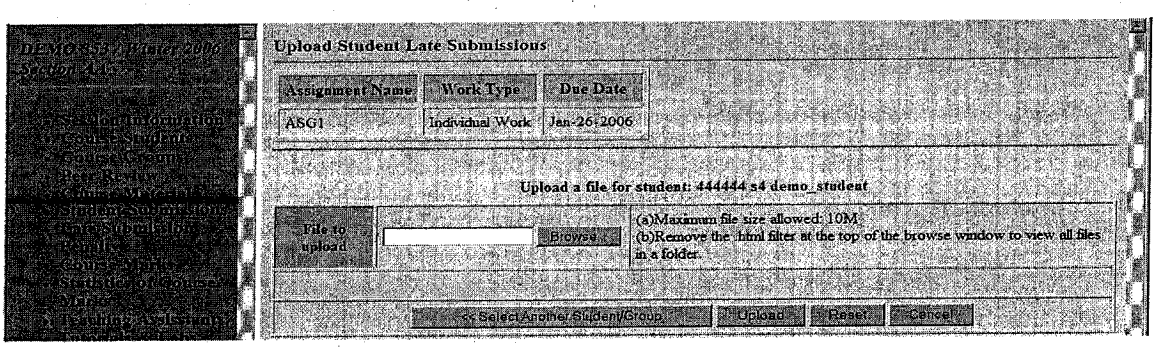


Figure 4.115 Upload Late Submissions – Step 2

4.5.5 Late Submission Penalty

The instructor might accept student late submissions with certain penalty. To set or update the late submission penalty rate, click on the "Late Submission Penalty" link in the left frame of the pages for the Course Instructor. The default setting for the penalty rate of late assignment/project submissions is 25% per day.

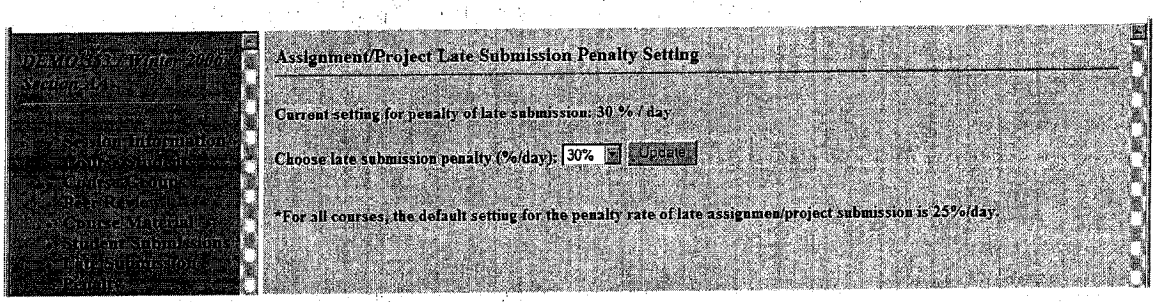


Figure 4.116 Late Submission Penalties

4.5.6 Course Marks

In the left frame of the pages for the Course Instructor, a "Course Marks" link is provided to group together the functionality required for managing the course marks for marked entities. Click on the "Course Marks" link, the main page for the course marks related features is displayed (see Figure 4.117). A "Help for Marking Policy" link is provided for the detail explanation on the marking related information.

4.5.8.1 Grading Schema

The instructor could set up a grading schema so that it can be applied to assign final letter grades to the students. Click on the "Set/Update Grade Schema" button (see Figure 4.117); the page for setting or updating the grading schema will be displayed (see Figure 4.118). There are two grading schema options for the instructor: the letter grade option (assign A+ to F to students) and the pass/fail option (assign either Pass or Fail to

students). Once the grading schema has been setup, the instructor could apply this schema by clicking on the "Assign Letter Grades According to the Schema" button (see Figure 4.117).

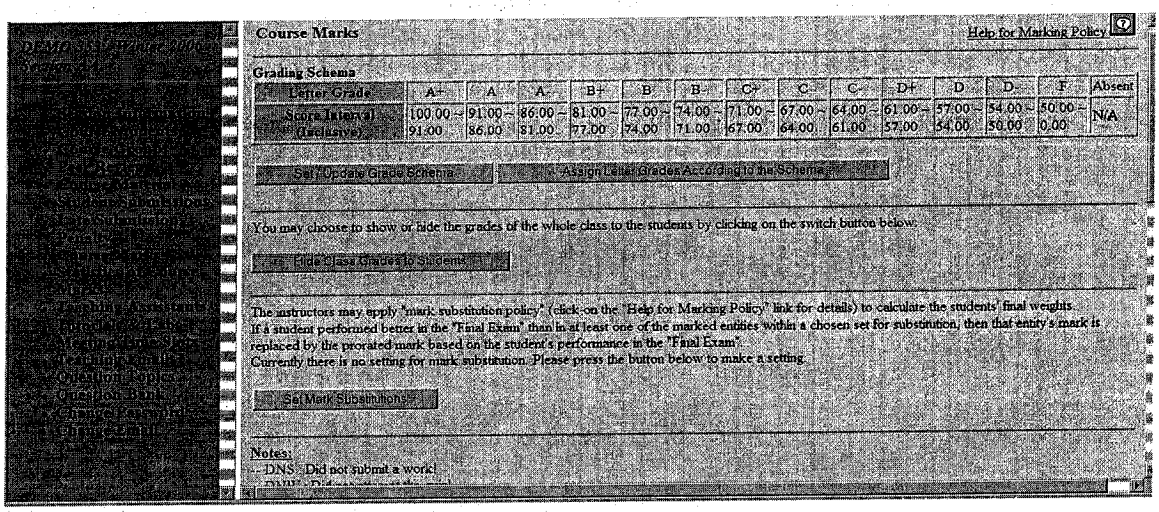


Figure 4.117 Course Marks Main Page

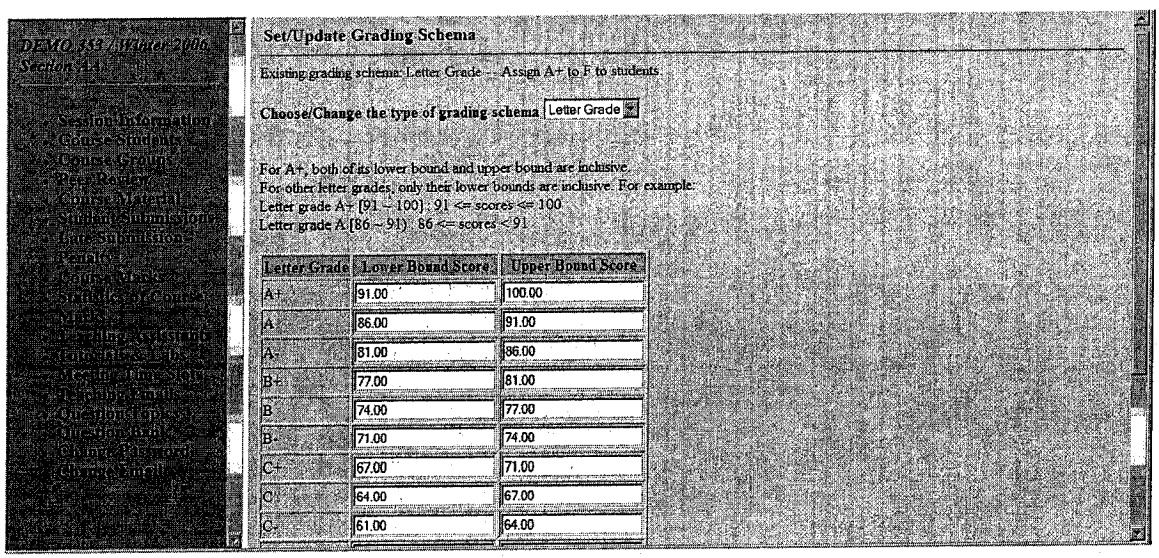


Figure 4.118 Set/Update Grading Schema

4.5.8.2 Show/hide class grades to students

The instructor could control whether to show or hide the class grades to students. Click on the "Show Class Grades to Students" button (see Figure 4.117); each course student is

allowed to view the grades of all students and the button will be changed to a "Hide Class Grades to Students" button. Similarly, click on the "Hide Class Grades to Students" button; a student is allowed to see only her own marks and the button will be changed to a "Show Class Grades to Students" button.

4.5.8.3 Show/hide letter grades to students

The instructor could control whether to show or hide the final letter grades to the students. If the final letter grades have been assigned to the students, a "Show Letter Grades to Students" button will appears. Click on the "Show Letter Grades to Students" button; a student is allowed to view his final letter grade and the button will be changed to a "Hide Letter Grades to Students" button. Similarly, click on the "Hide Letter Grades to Students" button; a student will not be able to see his final letter grade.

4.5.8.4 Mark substitutions

The instructors may create and apply the "mark substitution policy" to calculate the students' final weights. If a student performed better in the "Final Exam" than in at least one of the marked entities within a chosen set for substitution, then that entity's mark is replaced by the prorated mark based on the student's performance in the "Final Exam". Click on the "Set Mark Substitutions" button (see Figure 4.117); the page for setting mark substitutions is displayed (see Figure 4.119). Once the setting for mark substitutions is created, the system will calculate the students' final weights according to this setting.

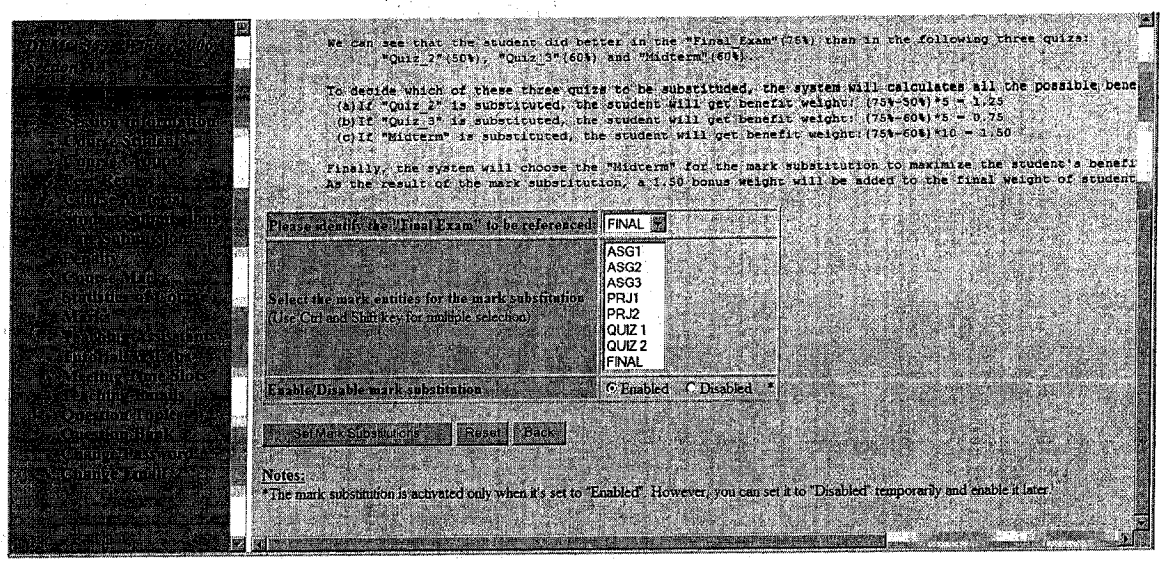


Figure 4.119 Set/Update Mark Substitutions

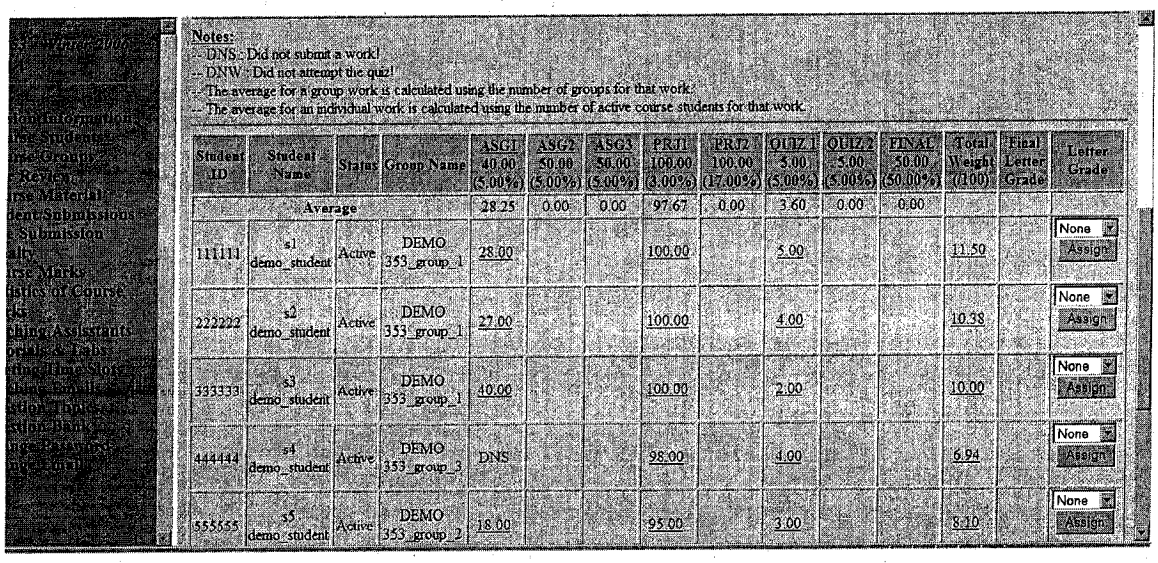


Figure 4.120 Course Marks List

4.5.8.5 Course marks list

At the bottom part of the main page for the course marks feature, the course marks for all marked entities are listed (see Figure 4.120). For each marked entity, the average mark is calculated. For each student, the current total weight is accumulated. Click on a mark; a new window will be opened to show the detail calculation and comments on the marking

(see Figure 4.121). For a group work, if peer review is required, the comments for the marks might change during the term accordingly. After the late submission deadlines, a "DNS" marking will be shown for each student that has not yet uploaded a submission. Similarly, a "DNW" marking will be shown for each student that did not attempt an assessment. Although the instructor can assign final letter grades by applying the grading schema, she still can assign or change the letter grades manually by using the "Assign" button for each student shown in Figure 4.120.

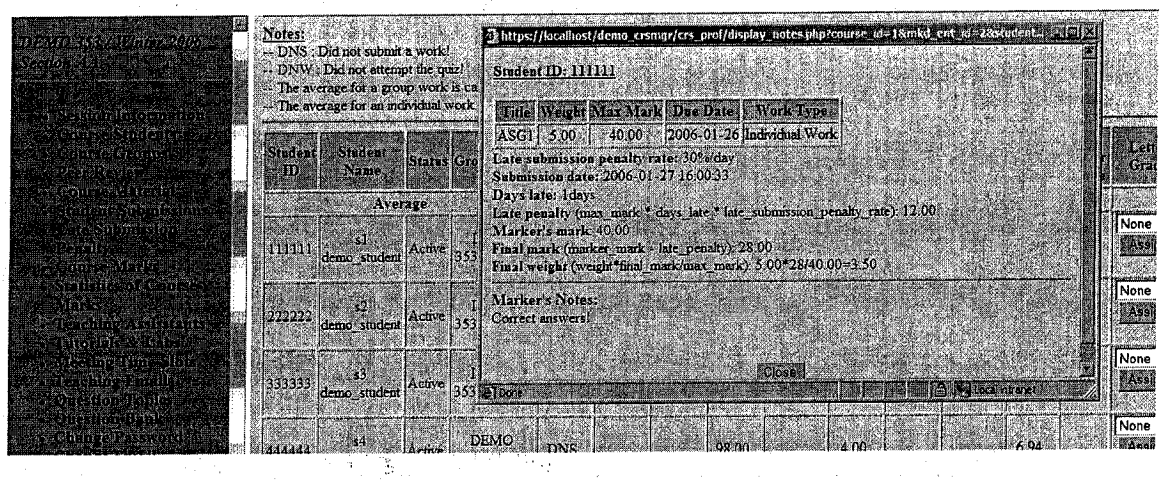


Figure 4.121 Course Mark Comments

4.5.8.6 Assign marks for individual work

To assign marks for the individual works, click on the header links for the corresponding course marked entities (see Figure 4.120); the students will be listed with their current marking information (see Figure 4.122). To mark a student, click on the student ID link; a new window will be opened to allow the instructor to insert the mark and the comments (see Figure 4.123). Instead of inputting comment in the given text box, the instructor could choose to upload a feedback file. For the convenience of the instructor, once a student is marked, the window for the next unmarked student is displayed.

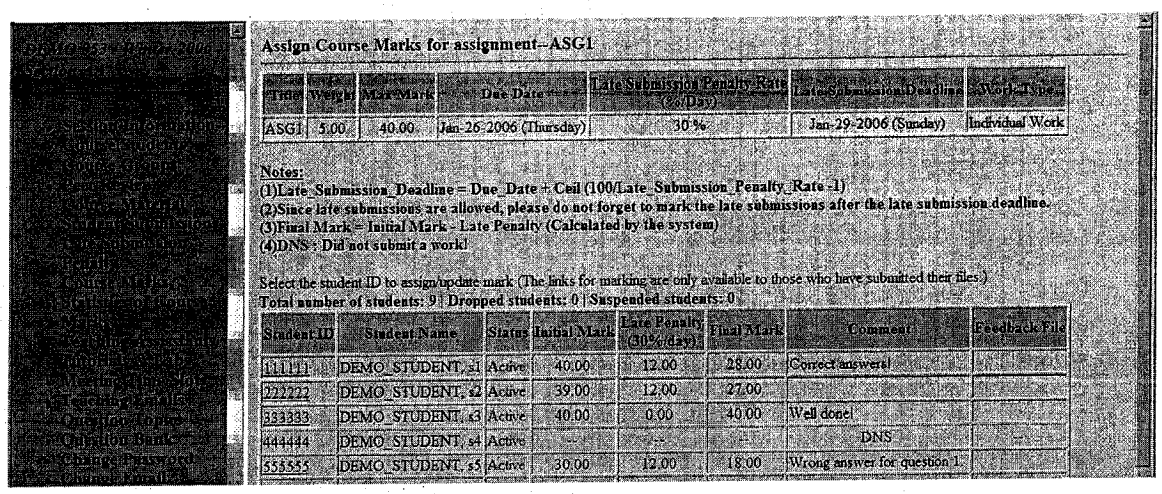


Figure 4.122 Assign Marks for Individual Works – Student List

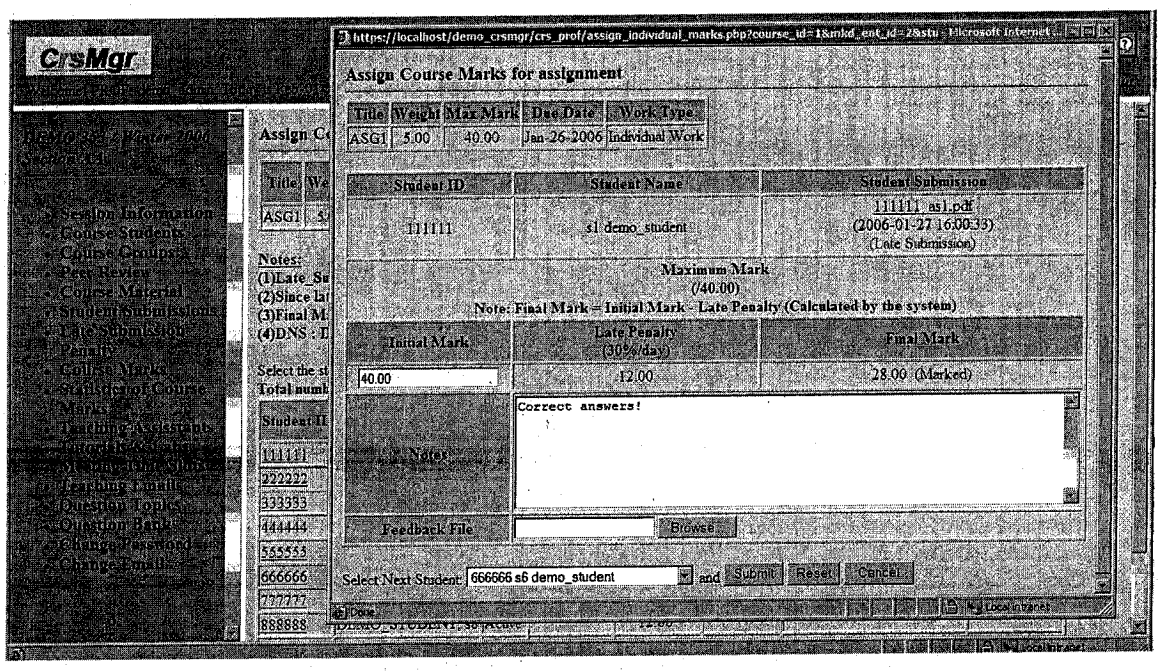


Figure 4.123 Assign Marks for Individual Works – Marking Window

4.5.8.7 Assign marks for group work

This is similar as to assign marks for the individual works. Instead of being input to each student, the marks are assigned to the groups (see Figure 4.124 and Figure 4.125). For the convenience of the instructor, once one group is marked, the window for the next unmarked group is displayed.

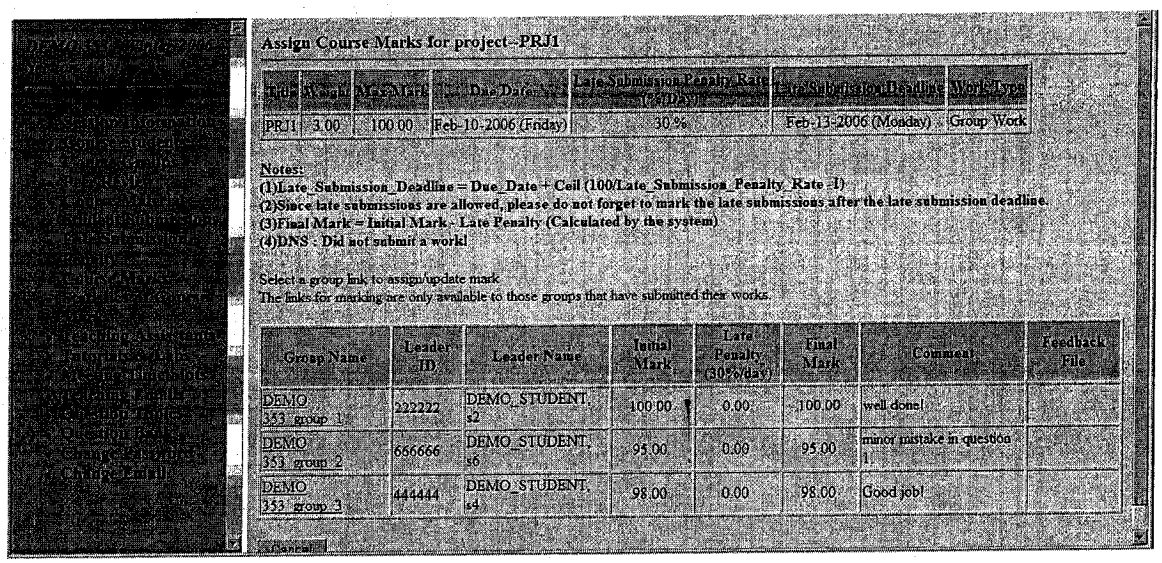


Figure 4.124 Assign Marks for Group Works – Group List

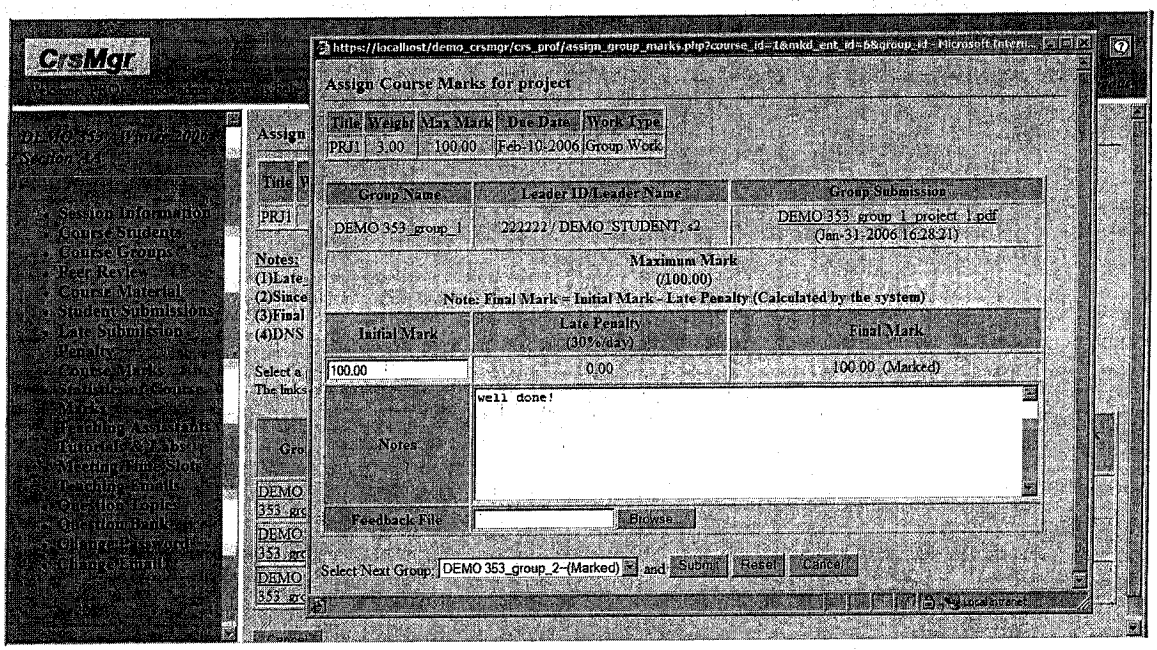


Figure 4.125 Assign Marks for Group Works – Marking Window

4.5.7 Statistics of Course Marks

Click on the "Statistics of Course Marks" link in the left frame of the pages for the Course Instructor; some useful statistics of the course marks are displayed (see Figure 4.126). For each marked entity, the maximum score, the minimum score, and the average

score are displayed. Furthermore, the score distribution is shown. For an assessment that contains multiple choice questions, the students' performance on each multiple choice question is displayed (see Figure 4.127).

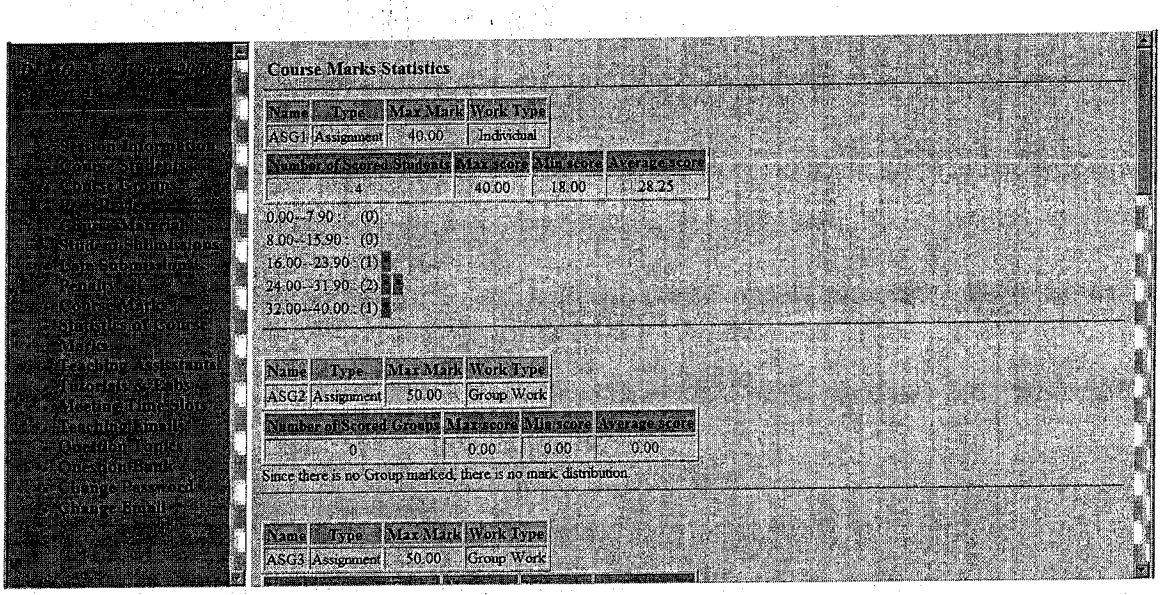


Figure 4.126 Statistics of Course Marks

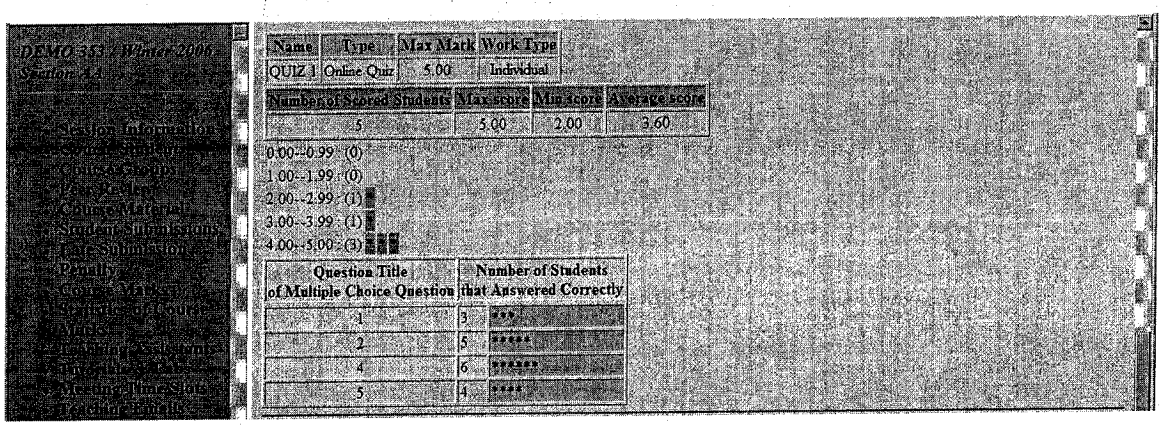


Figure 4.127 Students' Performance on Multiple Choice Questions

4.5.8 Teaching Assistants

The course instructor could add or remove teaching assistants by following the "Teaching Assistants" link in the left frame of the pages for the Course Instructor.

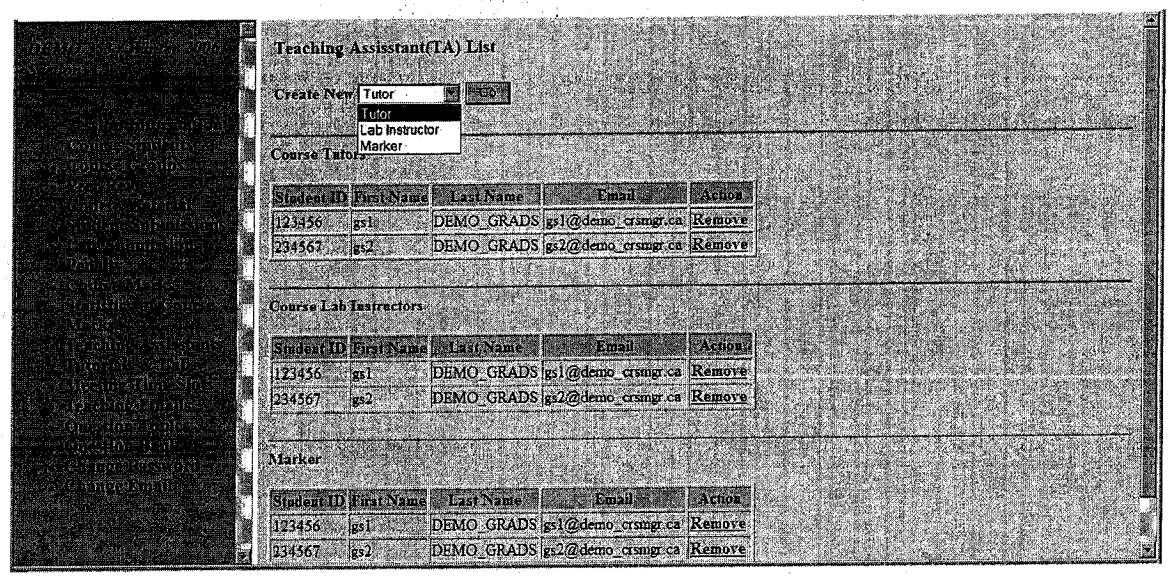


Figure 4.128 Teaching Assistants

4.5.9 Tutorials and Labs

Click on the "Tutorials & Labs" link in the left frame of the pages for the Course Instructor; the existing time slots for the tutorial and lab are displayed (see Figure 4.129).

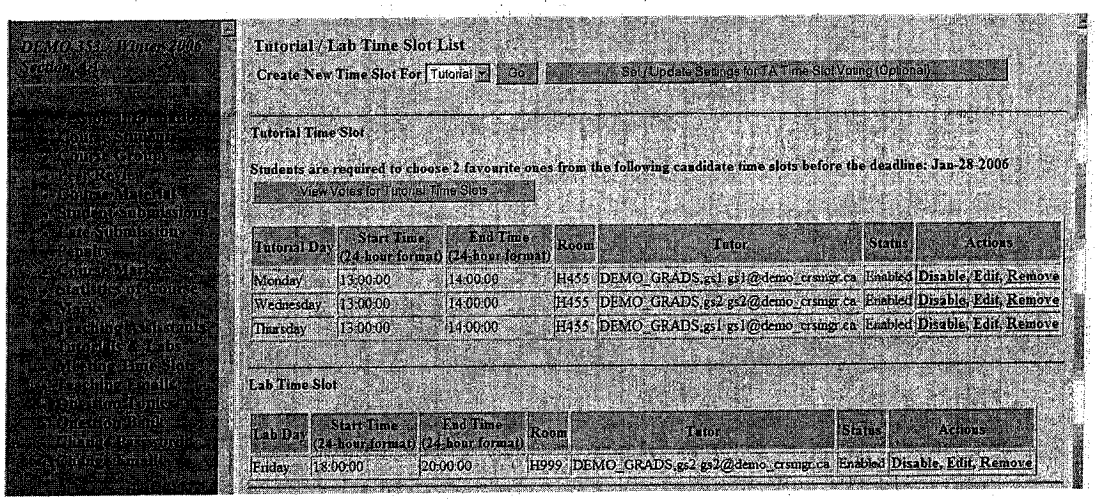


Figure 4.129 Tutorials and Labs

4.5.11.1 Create new time slots for tutorial and lab

Choose the type of the time slot from the pull-down list and click on the "Go" button (see

Figure 4.129); the page for creating new time slots is displayed (see Figure 4.130). As long as the rooms for the time slots are different, time slots with same period on the same week day are allowed.

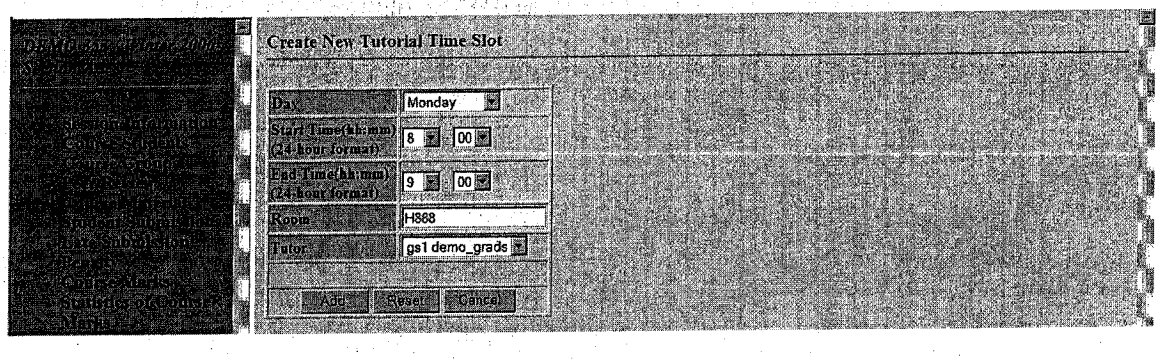


Figure 4.130 Create New Time Slots for Tutorials and Labs

4.5.11.2 Set/update settings for TA time slot voting

The course instructor may allow the students to vote for the time slots for the tutorial and lab before a deadline. Click on the "Set/Update Settings for TA Time Slot Voting" button shown in Figure 4.129 to make or update the setting for the vote (see Figure 4.131). The instructor may set a vote for one or both type of time slots. For each setting, the instructor should specify the number of final time slots to be chosen, and this number must be less than the number of candidate time slots. Also, a voting deadline must be specified.

4.5.11.3 View the votes for time slots

Click on the "View Votes for Tutorial Time Slots" button shown in Figure 4.129 to show the students' votes for the tutorial time slots. Figure 4.132 shows the votes. Similarly, if a vote is required for lab time slots, click on the "View Votes for Lab Time Slots" button to show the students' votes for the lab time slots.

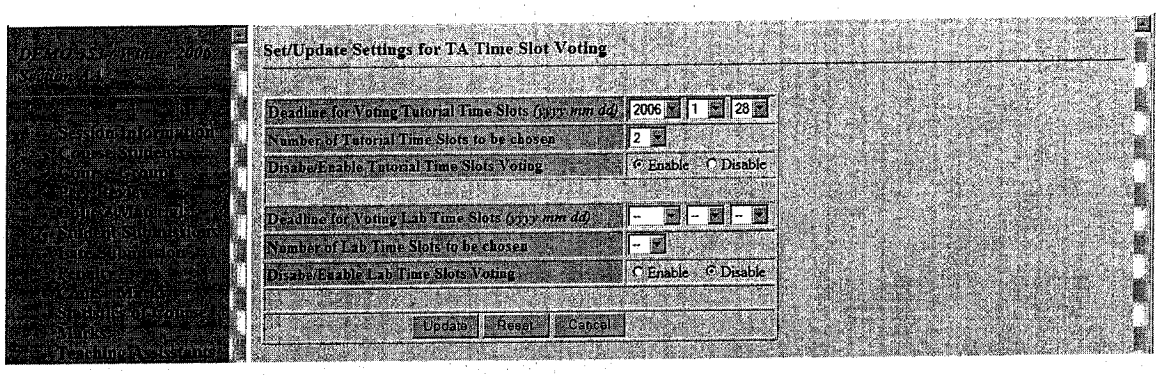


Figure 4.131 Setting for TA Time Slot Voting

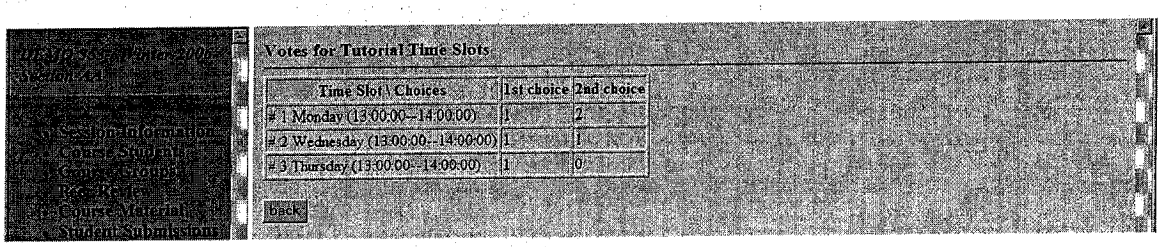


Figure 4.132 Votes for Tutorial Time Slots

4.5.11.4 Apply time slot votes

After the deadline for the time slot vote, the instructor may finalize the vote by clicking on the "Apply Tutorial Time Slot Votes" button shown in Figure 4.133. According to the result of the votes, the system will keep the final chosen ones as "Enabled" and disable the others. Similarly, if a vote is required for lab time slots, click on the "Apply Lab Time Slot Votes" button to finalize the vote.

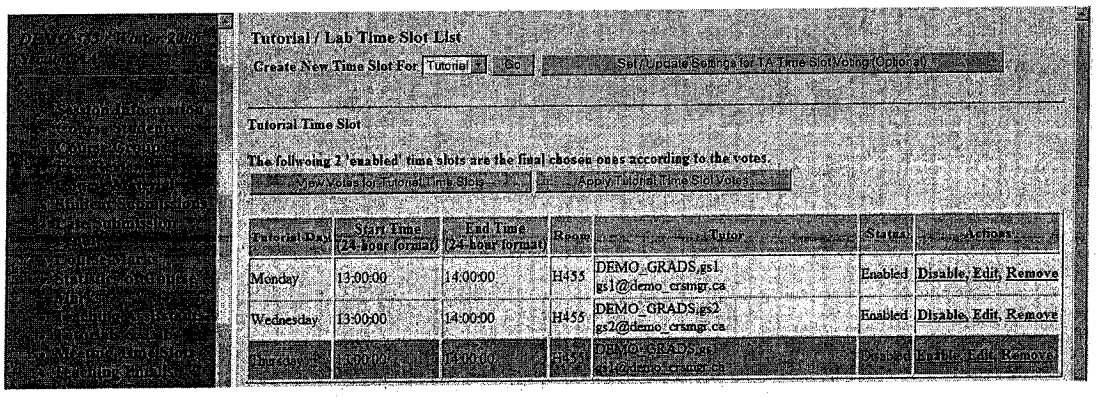


Figure 4.133 Apply Tutorial Time Slot Votes

4.5.10 Meeting Time Slots

The course instructor may create time slots for the purpose of consultation, individual demo, or group demo. The group demo meeting time slots could be reserved only by the group leaders. A student/group can only reserve one time slot for each purpose. Click on the "Meeting Time Slots" link in the left frame of the pages for the Course Instructor; the calendar for the current month as well as the existing meeting time slots in this month is displayed (see Figure 4.138). Click on the "<-" or "->" link to show the calendar for the previous or next month.

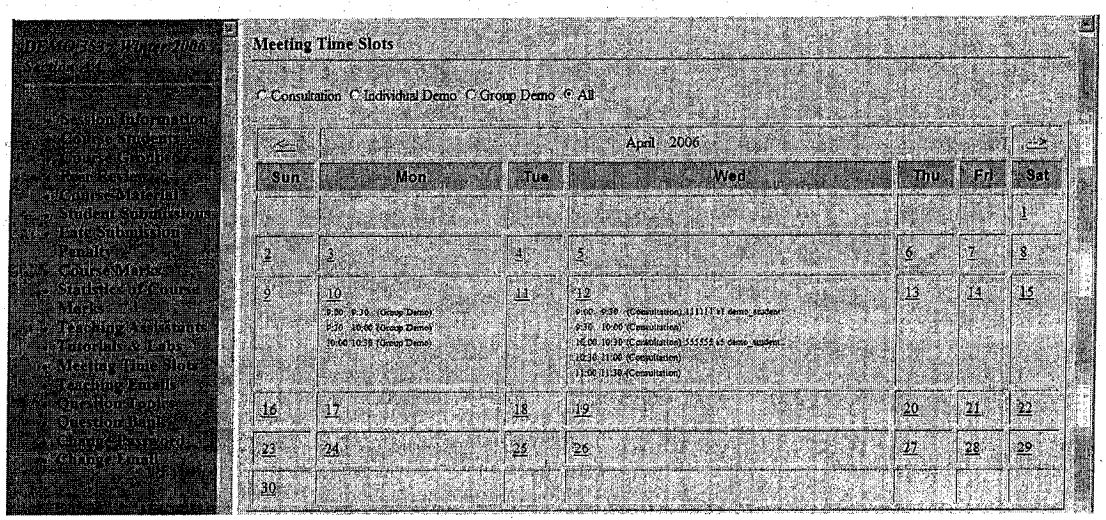


Figure 4.134 Meeting Time Slot Calendar

4.5.12.1 List the meeting time slots

To list the meeting time slots for a chosen date, click on the date link for that date (see Figure 4.135).

4.5.12.2 Create new meeting time slots

To create a new time slot, click on the "Create New Time Slot" button shown in Figure 4.135 (see Figure 4.136).

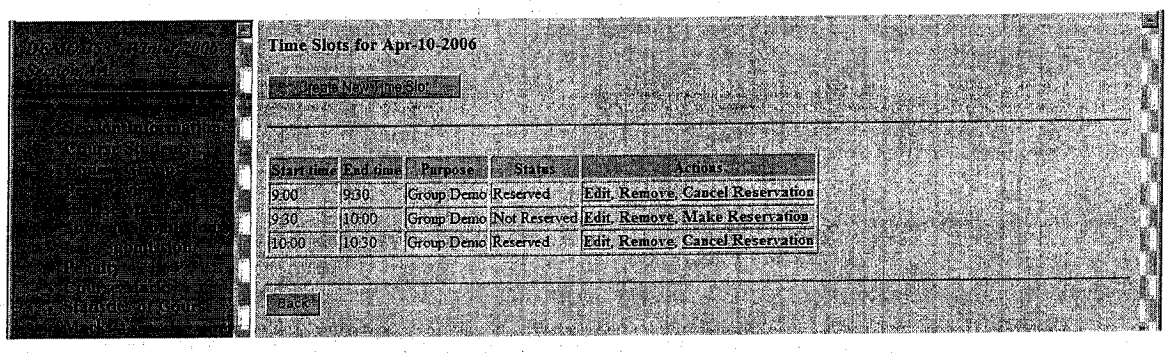


Figure 4.135 Meeting Time Slots List

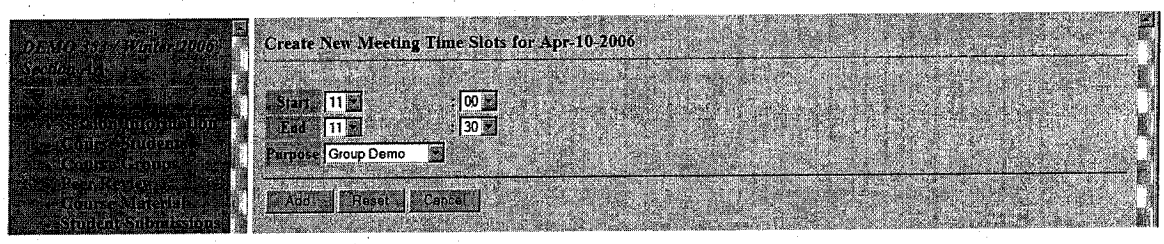


Figure 4.136 Create New Meeting Time Slots

4.5.12.3 Edit/remove meeting time slots

To edit or remove a meeting time slot, click on the "Edit" link or "Remove" link shown in Figure 4.135 for that time slot.

4.5.12.4 Make/cancel reservation for meeting time slots

To assign or cancel a reservation, click on the "Make Reservation" link or "Cancel Reservation" link shown in Figure 4.135 for that time slot (see Figure 4.137).

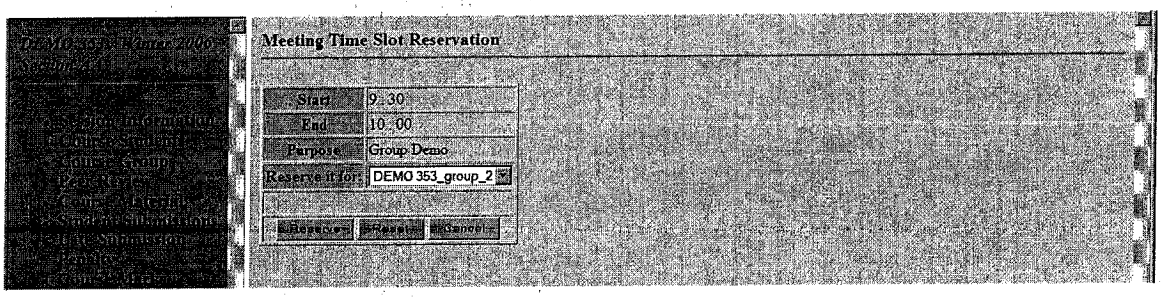


Figure 4.137 Meeting Time Slot Reservations

4.6 Thesis Supervisor

A thesis supervisor manages the graduate students and the thesis projects under his supervision. The features for changing password and email have already been discussed in section 4.1.1.5 and section 4.1.1.6.

4.6.1 Graduate Student List

Click on the "Graduate Students" link in the left frame of the pages for the Thesis Supervisor; the existing graduate students are listed by the level of thesis program (see Figure 4.138).

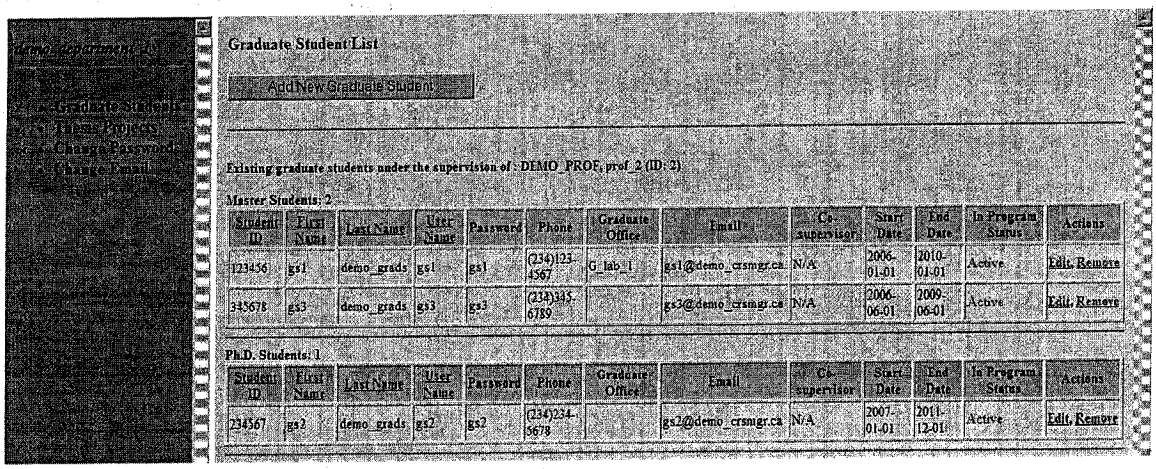


Figure 4.138 Graduate Student List

4.6.2 Edit/Remove Graduate Students

To edit the information of a graduate student, click on the "Edit" link (see Figure 4.138) for that student. Similarly, to remove a graduate student from the supervision, click on the "Remove" link for that student. Figure 4.139 shows the page for editing a graduate student.

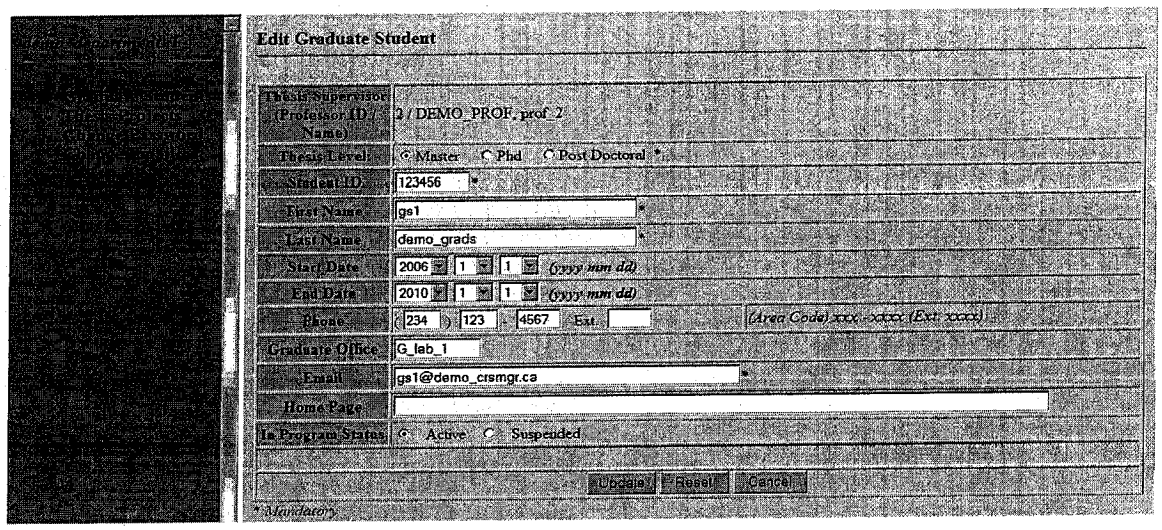


Figure 4.139 Edit Graduate Student

4.6.3 Add Graduate Students

To add a graduate student to the supervision, click on the "Add New Graduate Student" button shown in Figure 4.138. A supervision relationship between a graduate student and a supervisor must be unique for a thesis level. However, a graduate student can be co-supervised, i.e., a graduate can have more than one supervisor for the same thesis level.

4.6.4 Thesis Project List

Click on the "Thesis Project" link in the left frame of the pages for the Thesis Supervisor; the existing thesis projects are listed by the level of thesis program (see Figure 4.140).

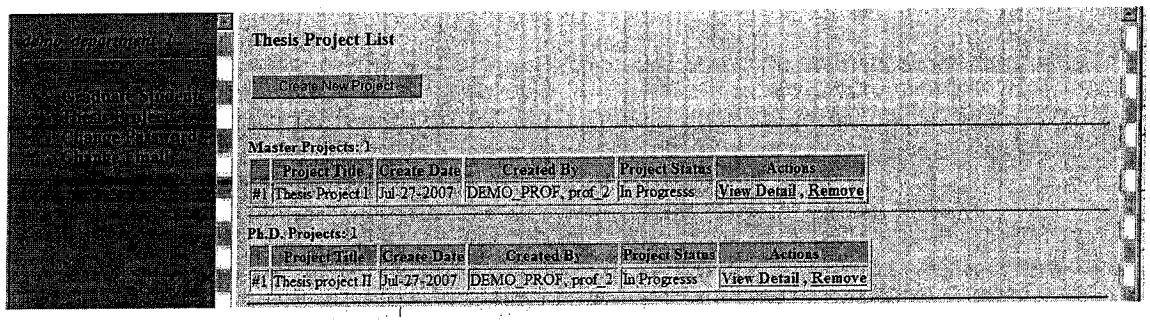


Figure 4.140 Thesis Project List

4.6.5 Create New Thesis Project

To create a new thesis project, click on the "Create New Project" button shown in Figure 4.140. Figure 4.141 shows the page for creating a new project.

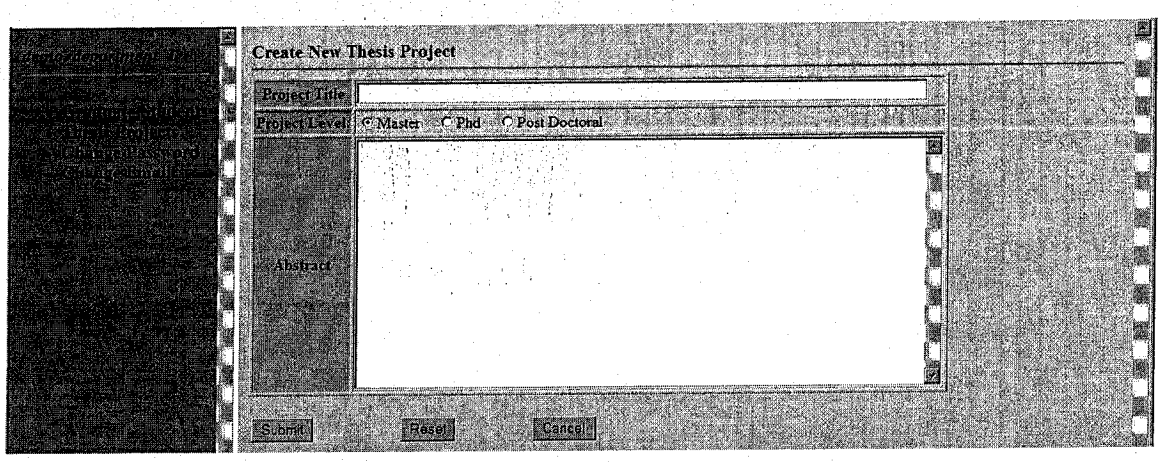


Figure 4.141 Create New Thesis Project

4.6.6 Remove Thesis Project

To remove a thesis project, click on the "Remove" link shown in Figure 4.140. A referenced thesis project cannot be removed.

4.6.7 Thesis Project Details

To view the details of a thesis project, click on the "View Detail" link for that project (see Figure 4.140). Figure 4.142 shows the details for a project. The existing project students and the uploaded project files are listed.

4.6.8 Edit Thesis Project

To edit the project information, click on the "Edit project info" link (see Figure 4.142).

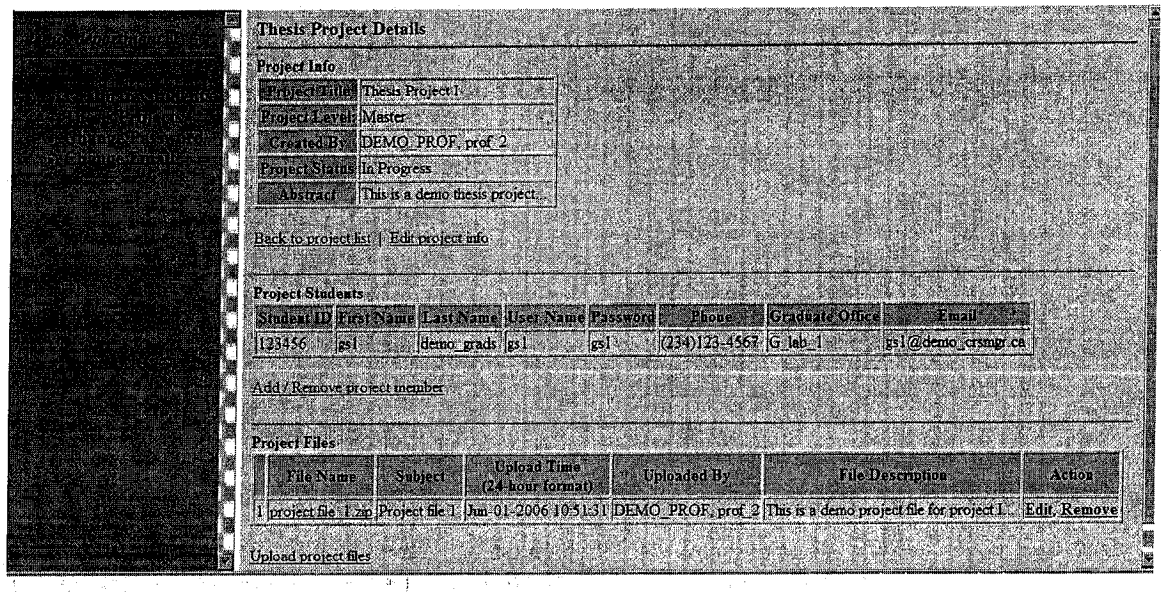


Figure 4.142 Thesis Project Details

4.6.9 Add/Remove Project Member

To assign graduate students to a project or to remove graduate students from a project, click on the "Add/Remove project members" link shown in Figure 4.142 (see Figure 4.143).

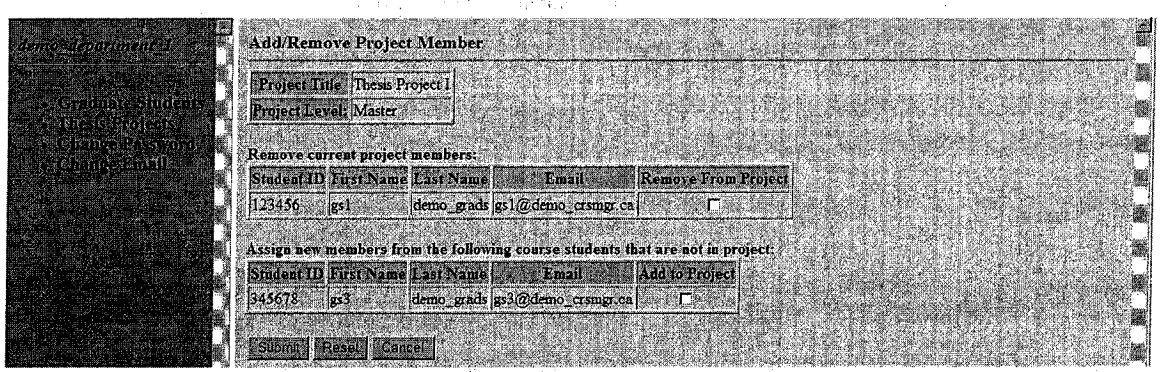


Figure 4.143 Add/Remove Project Members

4.6.10 Project Files

Both the thesis supervisors and the graduate students that are in project are allowed to upload files to a project. Click on the "Upload project files" link shown in Figure 4.142;

the page for uploading a project file is displayed (see Figure 4.144). To update or remove an uploaded project file, click on the "Edit" or "Remove" link for that file (see Figure 4.142).

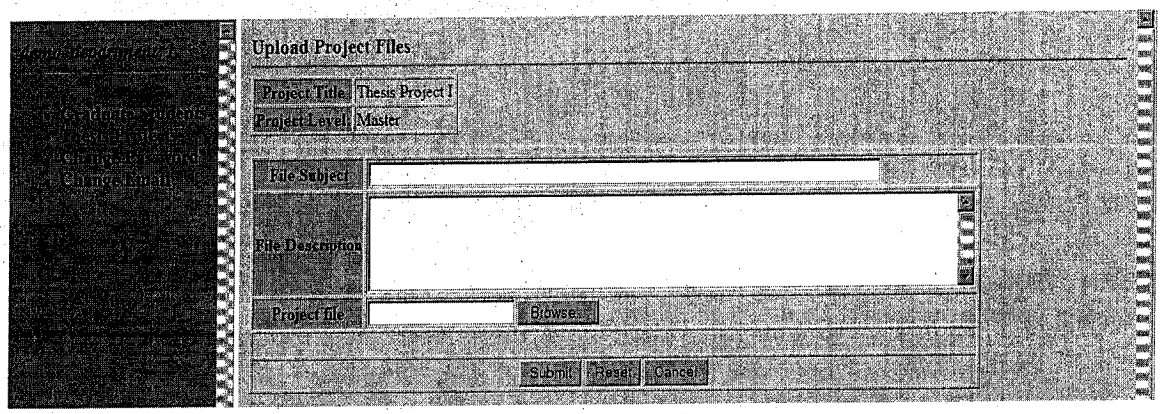


Figure 4.144 Upload Project Files

4.7 Course Student

A Course Student access the course section(s) that she takes and perform course related operations. For example, a course student uploads submissions for assignments and takes online assessments during the time windows set by the instructor. The features for changing password and email have already been discussed in section 4.1.1.5 and section 4.1.1.6.

4.7.1 Contact Information

Click on the "Contact Information" link in the left frame of the pages for the Course Student; the contact information on the course instructor and all TAs is listed (see Figure 4.145).

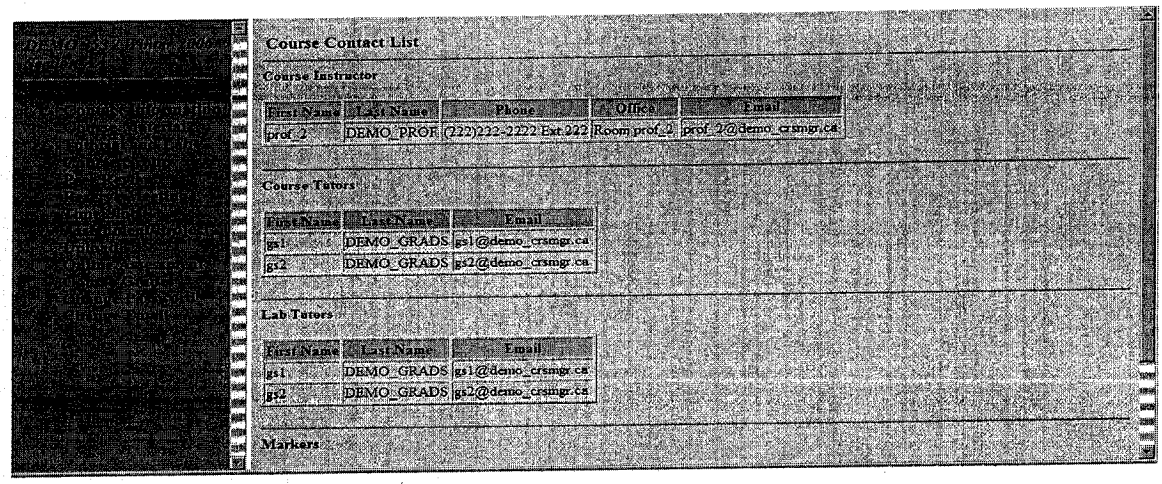


Figure 4.145 Course Contact Information

4.7.2 Course Material

Click on the "Course Material" link in the left frame of the pages for the Course Student; all the course materials as well as their detail information are listed by types. The course student can choose to view only some selected types of course materials and keep others shown as hidden (see Figure 4.146). The course student is allowed to download the uploaded files for course material.

4.7.3 Tutorial and Lab

Click on the "Tutorial and Lab" link in the left frame of the pages for the Course Student; the existing times slots for the tutorials and labs are listed. If the instructor has setup a vote for the time slots, the course students could vote for the preferred slots from the candidate slots before the deadlines. To make or update the votes for tutorial time slots, click on the "Vote/Update your votes for tutorial time slots" button (see Figure 4.147). Figure 4.148 shows the page for making or updating votes. After the deadline for the vote, the final time slots will be chosen by the instructor based on the students' votes.

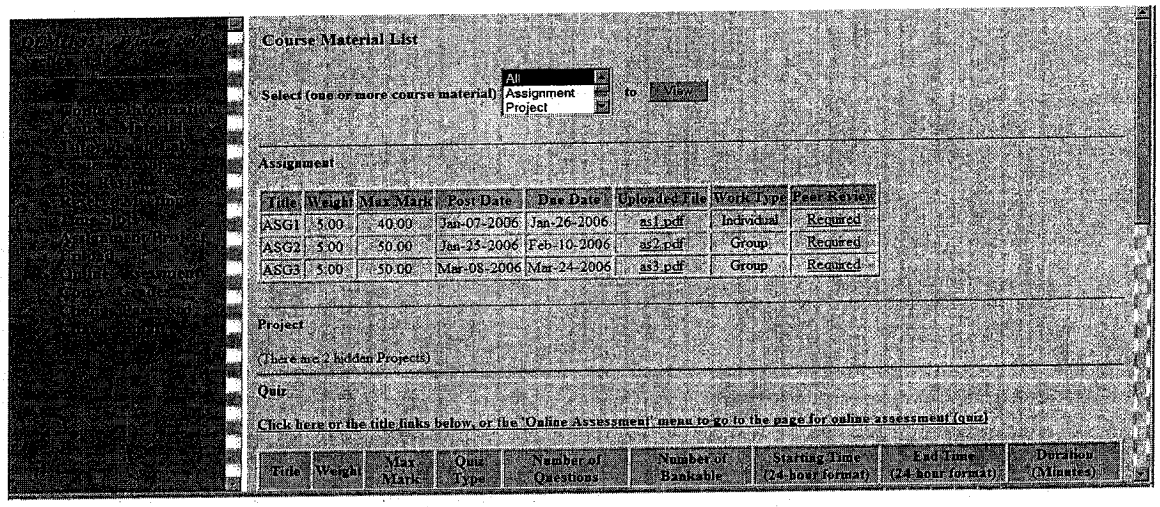


Figure 4.146 Course Materials

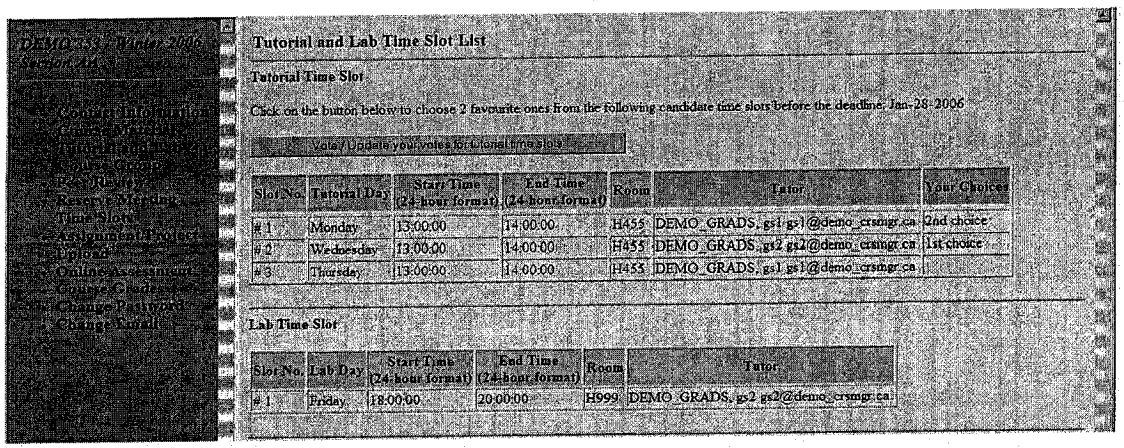


Figure 4.147 Tutorials and Lab Time Slot List

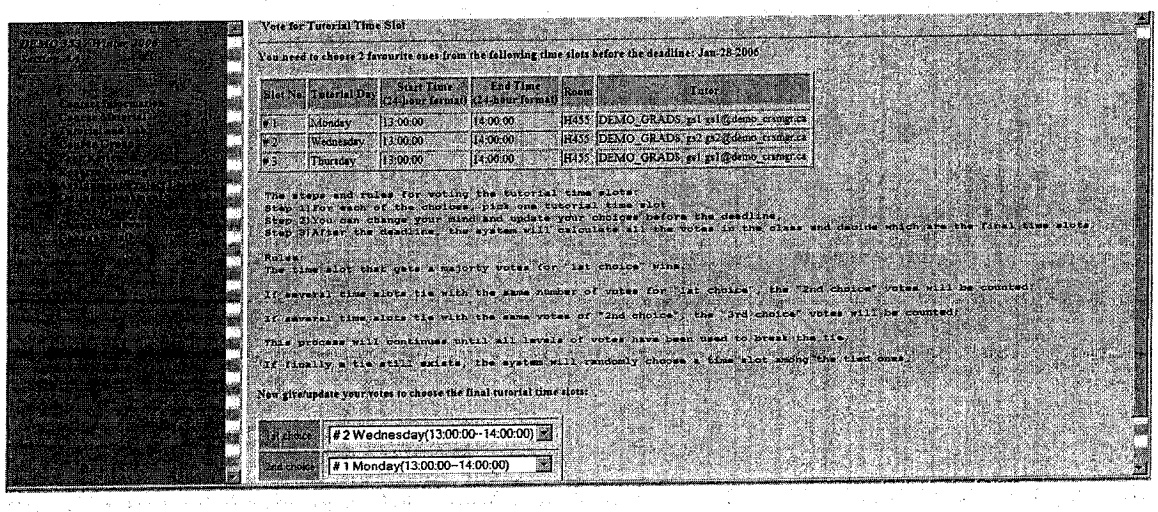


Figure 4.148 Make/Update Votes for Tutorial Time Slots

4.7.4 Course Group

If group work is required in the course, the course student needs to join a course group. To join a course group, click on the "Course Group" link in the left frame of the pages for the Course Student; the web page containing the detail instructions for how to join a course group is displayed (see Figure 4.149).

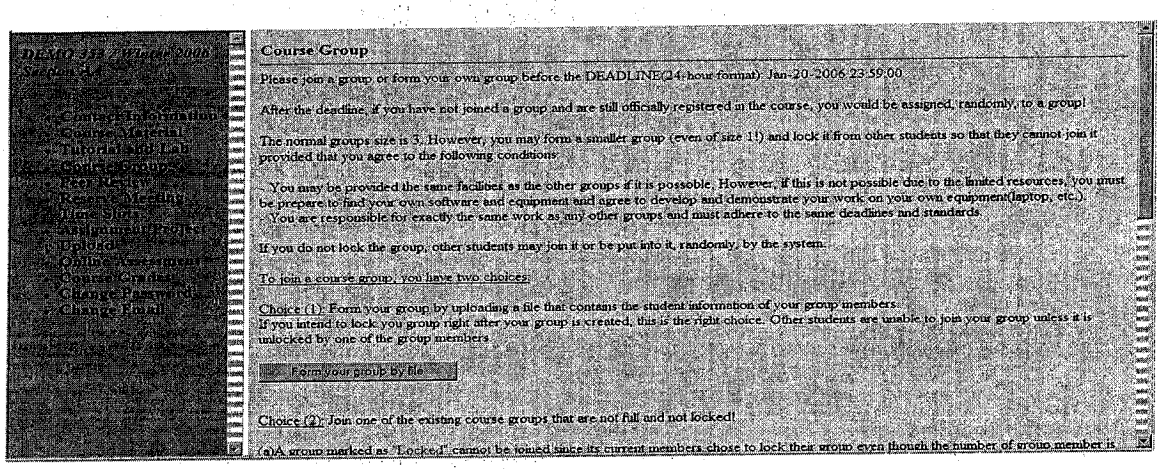


Figure 4.149 Instructions for Joining Group

A student should join a group before the join group deadline set by the instructor. After the deadline, any student that has not joined a group will be assigned randomly to a group. To join a group, a student has two choices: (a) Form a group by uploading a file that contains the student information of the group members; (b) Join one of the existing course groups that are not full and not locked.

4.7.4.1 Form a group by uploading a file

If a course student intends to lock her group right after the group is created, this is the right choice. Other students are unable to join this group unless it is unlocked by one of the group members. Click on the "Form your group by file" button shown in Figure 4.149; the page for creating a group by uploading a text file is displayed (see Figure

4.150). The text file must contain the information of all group members that is in a specified format. Detail instructions are available on the page shown in Figure 4.150.

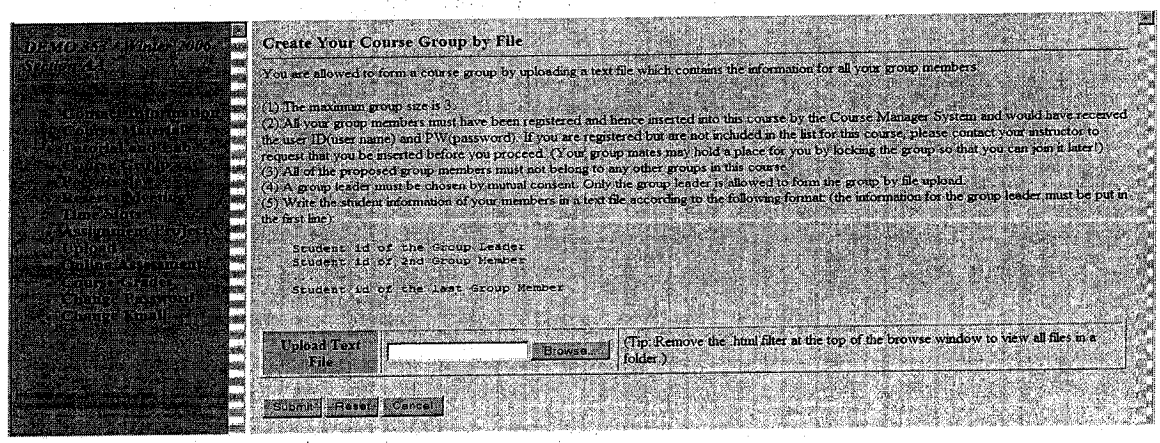


Figure 4.150 Create Course Group by Uploading a File

4.7.4.2 Join an existing group

A course group could be displayed with one of the three statuses: Locked, Full, or Available. A course student may join one of the existing course groups that are not full and not locked. Before joining a group, the course student may check the group details by clicking on the "View group details" button; a new window will be opened to display the details of a group (see Figure 4.151).

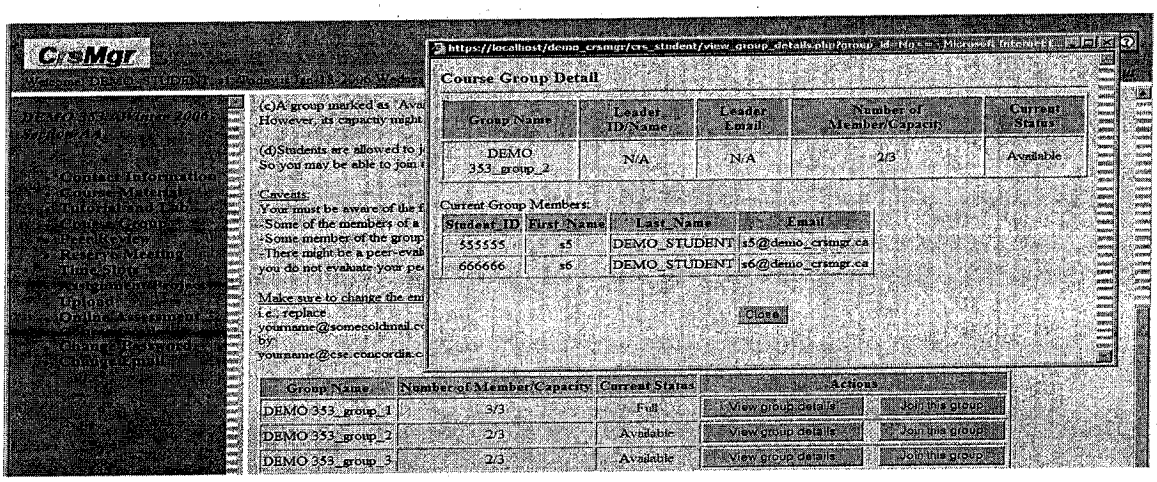


Figure 4.151 Course Group List

Click on the "Join this group" button for the group that is to be joined (see Figure 4.151), the page containing the group detail information is displayed (see Figure 4.152). Click on the "Join This Group" button to confirm the request.

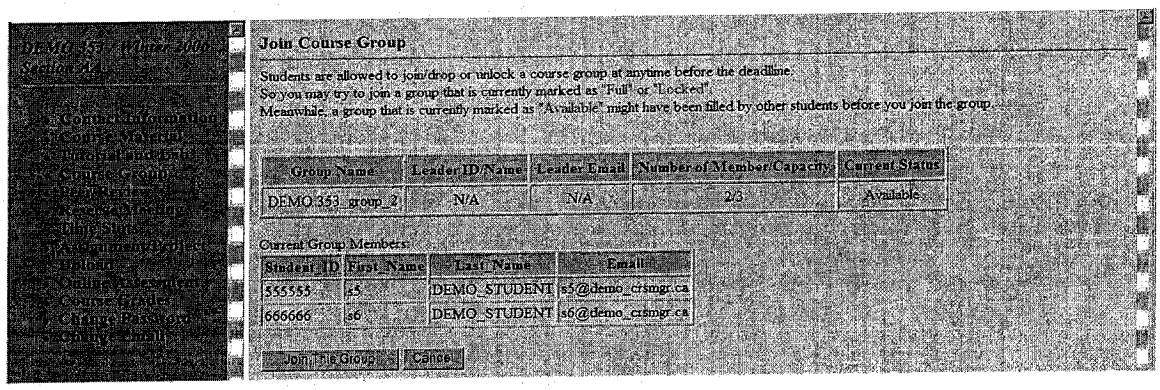


Figure 4.152 Join Course Group

4.7.4.3 Lock/unlock course group

If the student is able to join a group successfully, the page containing the information for the current group will be displayed (see Figure 4.153). The student may then lock the group by clicking on the "Lock Group" button or unlock the group by clicking on the "Unlock Group" button later. When a course group is locked, no other students could join this group even it's not full.

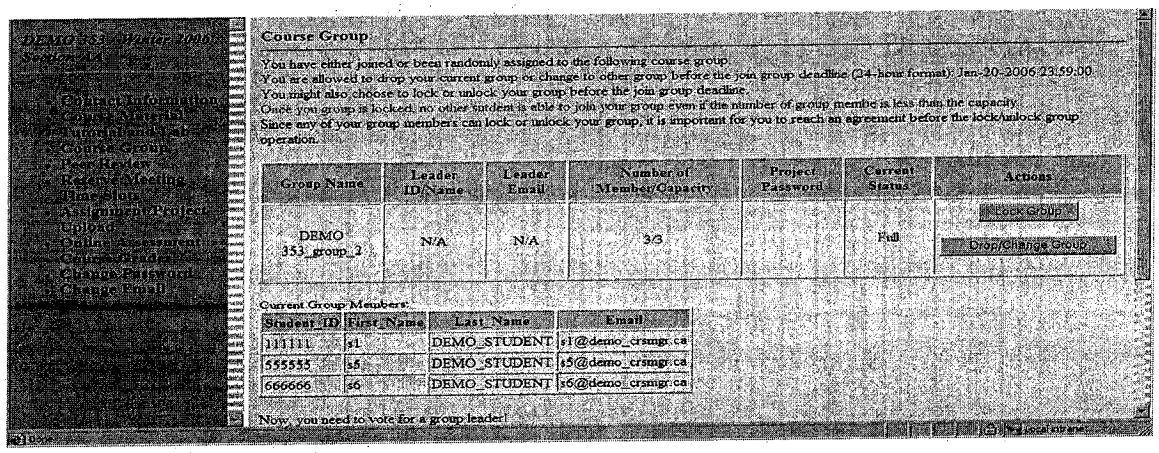


Figure 4.153 Current Group Details

4.7.4.4 Drop/change course group

Before the join group deadline, a student in a group may change to another course group or simply drop out of the current group by clicking on the "Drop/Change Group" button (see Figure 4.153).

4.7.4.5 Vote for group leader

If a course group dose not has a group leader, its group members are required to vote for a leader before a deadline set by the instructor (see Figure 4.154). After the deadline, a group leader will be chosen according to the votes for each group whose members have participated in the vote. However, if none of the group members of a group participated in the vote, the system will assign randomly a group leader for this group. Click on the "Vote/update your votes for a leader" link shown in Figure 4.154; the page for making or updating the leader votes is displayed (see Figure 4.155). The detail explanation on the rules for the vote is available on the page shown in Figure 4.155. A student should rank all the group members based on the order of preference; no member could be assigned a same rank order as the others.

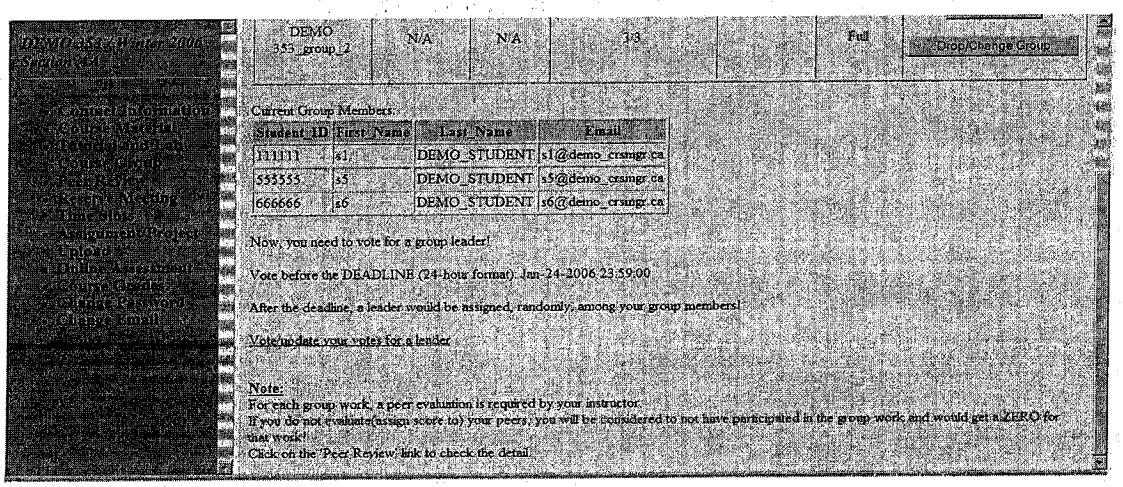


Figure 4.154 Link for the Group Leader Vote

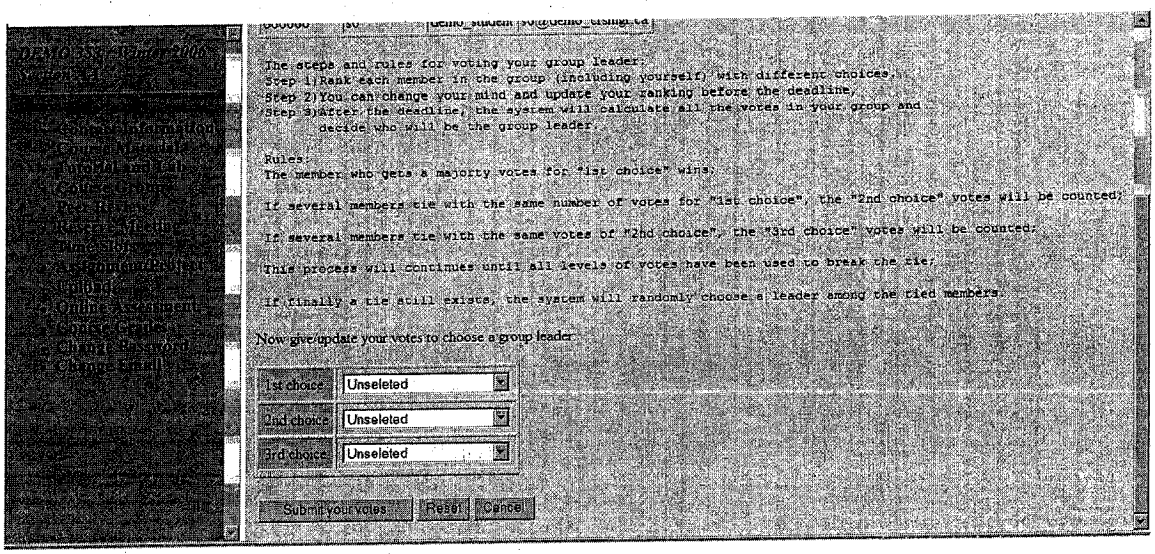


Figure 4.155 Votes for the Group Leader

4.7.5 Peer Review

A course student could participate in peer review by follow the "Peer Review" link in the left frame of the pages for the Course Student. According to the peer review type, different pages will be shown after the "Peer Review" link is clicked on.

4.7.5.1 Single peer review

If the course instructor requires the students to perform a single peer review for all group works at the end of the term, the page that the "Peer Review" link links to is shown as Figure 4.160.

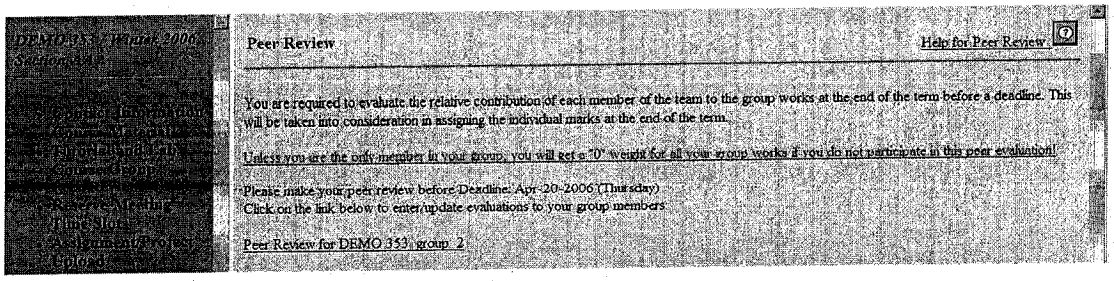


Figure 4.156 Peer Review Introductions – Single Peer Review

Figure 4.157 shows the page for the peer review for the group "Demo_353_group_2" after the "Peer Review for DEMO_353_group_2" link is clicked on. The upper part of the page shows the peer review scores that the student receives from his group members, and the lower part of the page shows the scores that the student give to his group members. To evaluate or update the evaluations to a group member, click on the "Enter Evaluation" button or the "Update Evaluation" button for that group member; the page for entering or updating the evaluation will be displayed (see Figure 4.158).

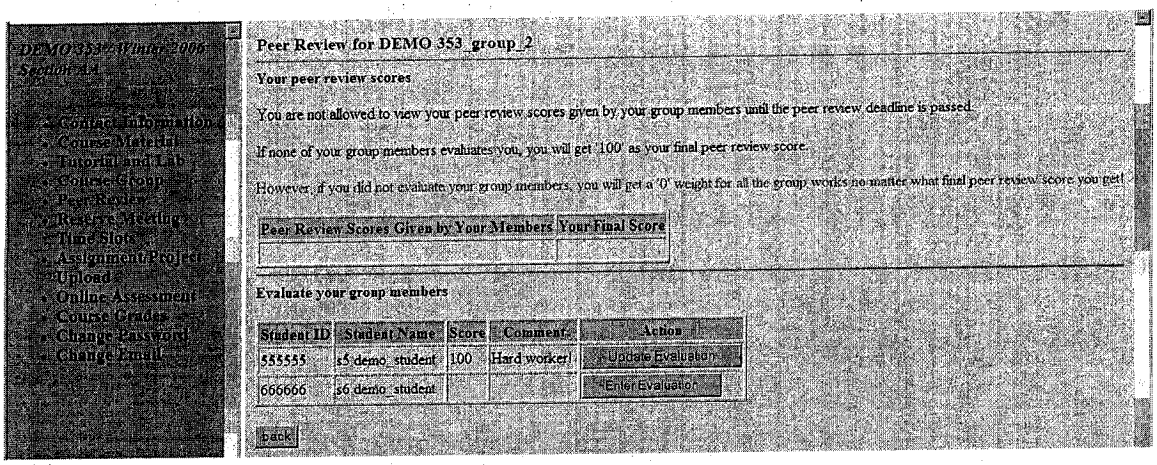


Figure 4.157 Peer Review – Single Peer Review

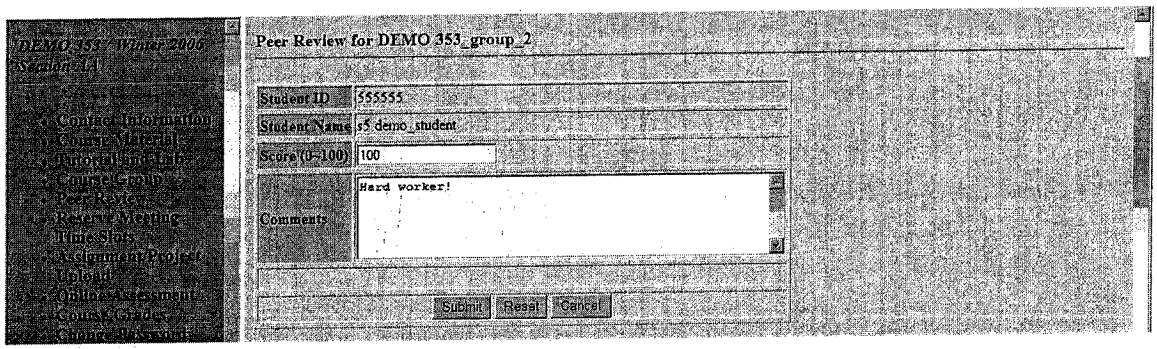


Figure 4.158 Enter/Update Peer Evaluation

4.7.5.2 One peer review for each group work

If the course instructor requires the students to perform one peer review for each group

work, the page that the "Peer Review" link links to is shown as Figure 4.159. All group works are listed with their due dates and peer review deadlines. Click on the title link for a group work to show the page for the peer review for that group work (see Figure 4.160). Similar as discussed for the single peer review, the upper part of the page shows the peer review scores that the student receives from his/her group members, and the lower part of the page shows the scores that the student give to his/her group members (see Figure 4.160). To evaluate or update the evaluations to a group member, click on the "Enter Evaluation" button or the "Update Evaluation" button for that group member.

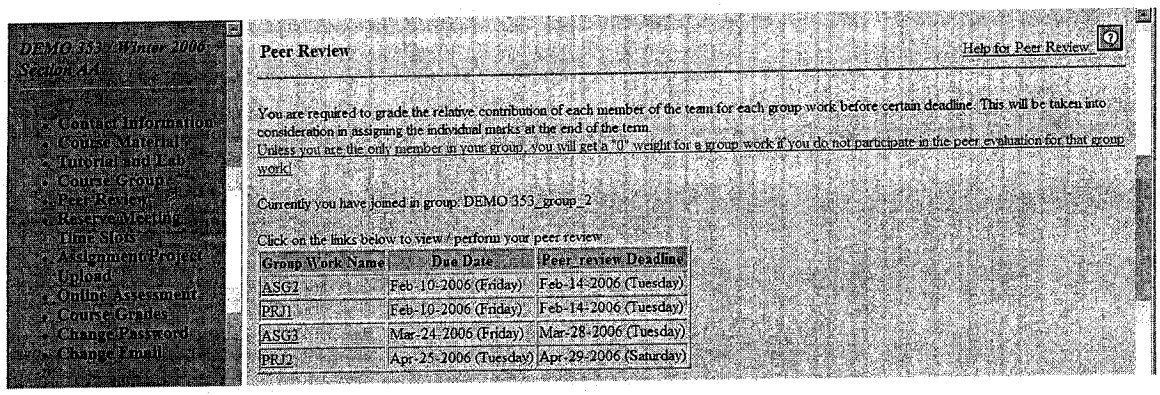


Figure 4.159 Peer Review Introductions – One Peer Review for Each Group Work

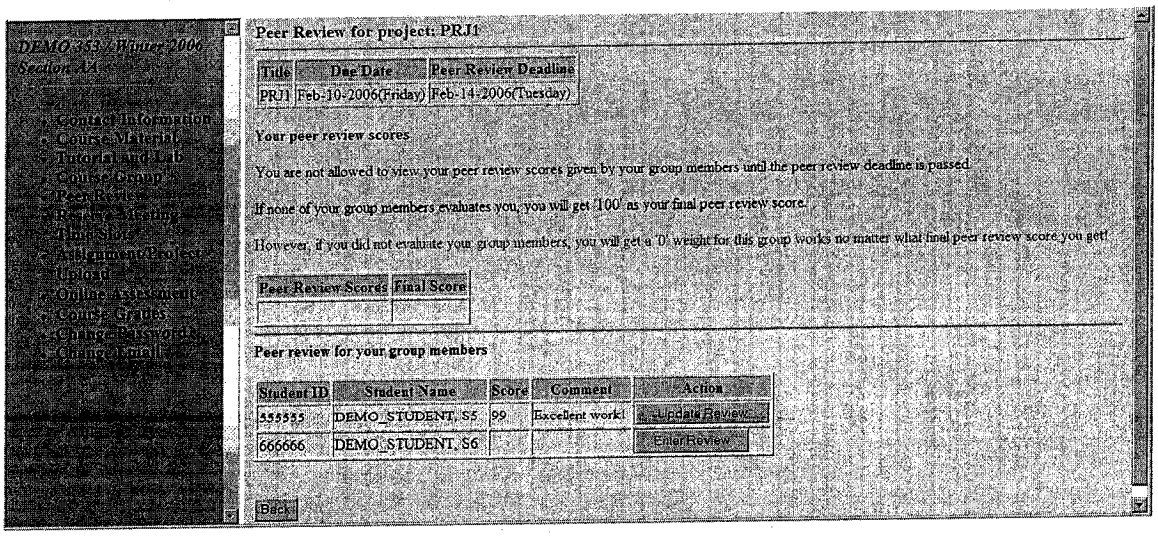


Figure 4.160 Peer Review – One Peer Review for Each Group Work

4.7.6 Reserve Meeting Time Slots

As was discussed in section 4.5.12 for the Course Instructor, the course instructor may create meeting time slots that could be reserved by the students for the purpose of consultation, individual demo, or group demo. To reserve a time slot, click on one of the active links for the time slots. Similarly, to cancel a reservation for a time slot, click on the link for that time slot. If a student wishes to change to another time slot, she must cancel the outstanding one first, and the cancellation of a time slot must be done two days before the meeting date.

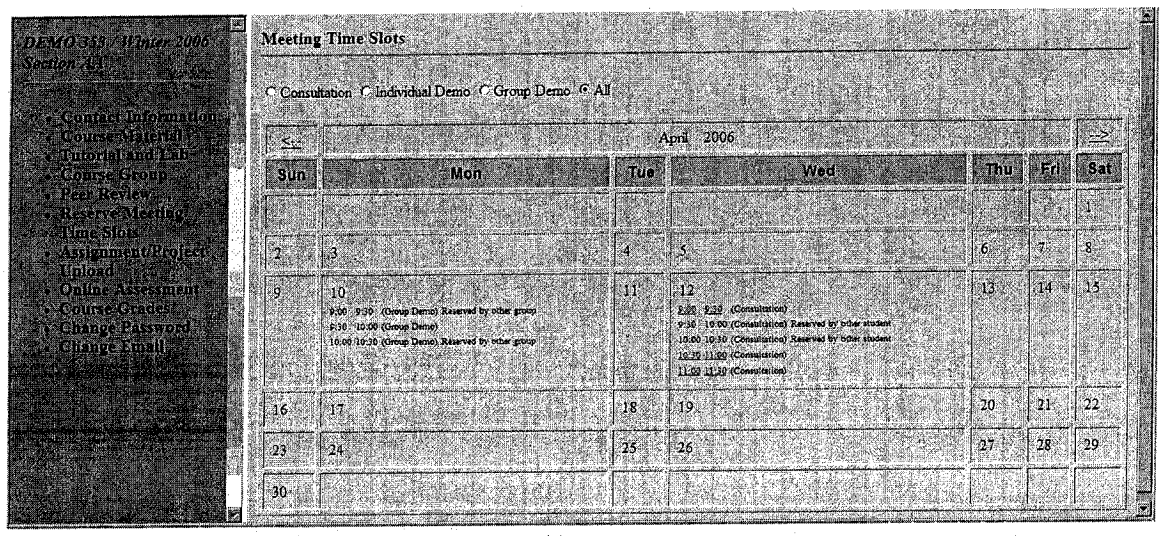


Figure 4.161 Meeting Time Slot Calendar

4.7.7 Assignment/Project Upload

The course students should upload their submissions for the assignments/projects on or before the due dates. Late submission might be accepted but at the cost of certain penalty set by the instructor. Click on the "Assignment/Project Upload" link; the summary for all the submissions of a student and/or her group is displayed (see Figure 4.162).

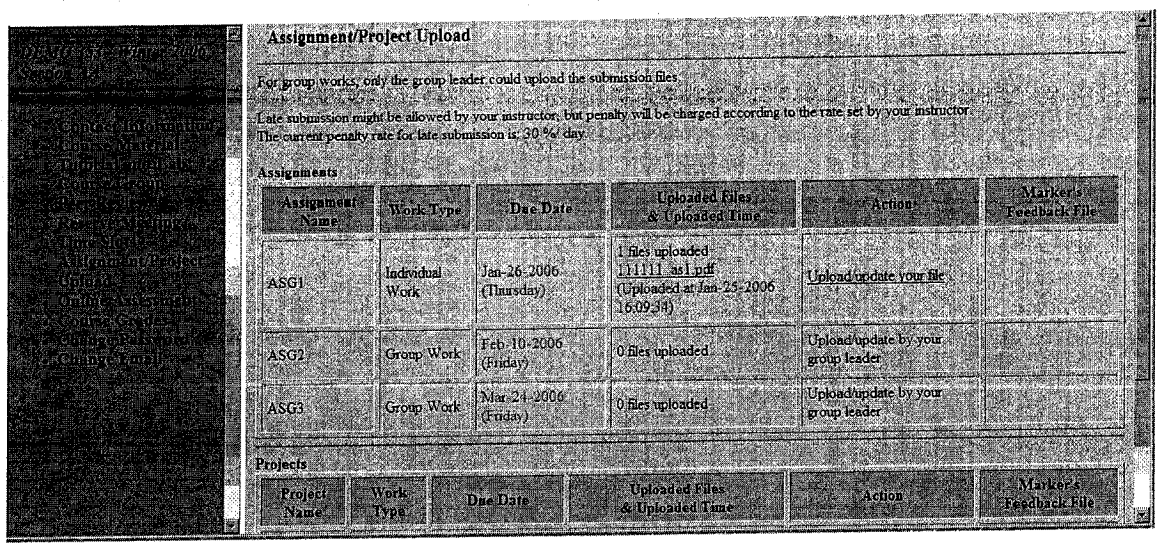


Figure 4.162 Summaries for Student Submissions

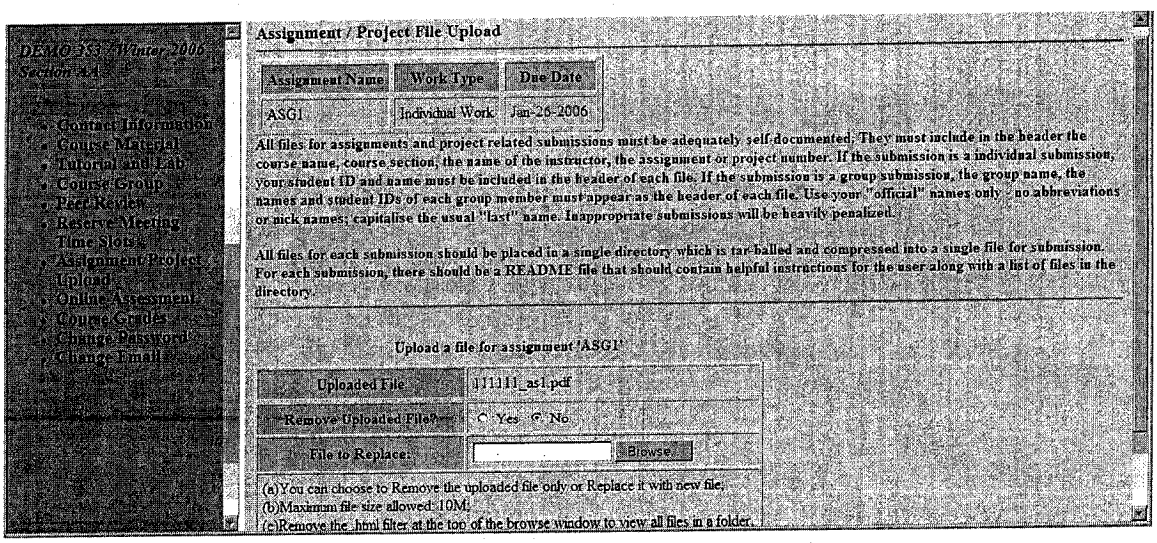


Figure 4.163 Assignment/Project File Upload

For the group works, only the group leaders are able to upload/update the group submissions. For each assignment/project, the due date and the uploading time stamp of the submission are displayed. Students are allowed to download the uploaded submission file and the marker's feedback files. Click on the "Upload/update your file" link available to the student; the page for uploading/updating submission is displayed as Figure 4.163.

4.7.8 Online Assessment

The course students may take online assessments during a specific time windows set by the instructor. Click on the "Online Assessment" link in the left frame of the pages for the Course Student; the important instructions on how to take an online assessment as well as the list of existing online assessments are displayed (see Figure 4.164). The title link of an assessment will be active only during the preset time window.

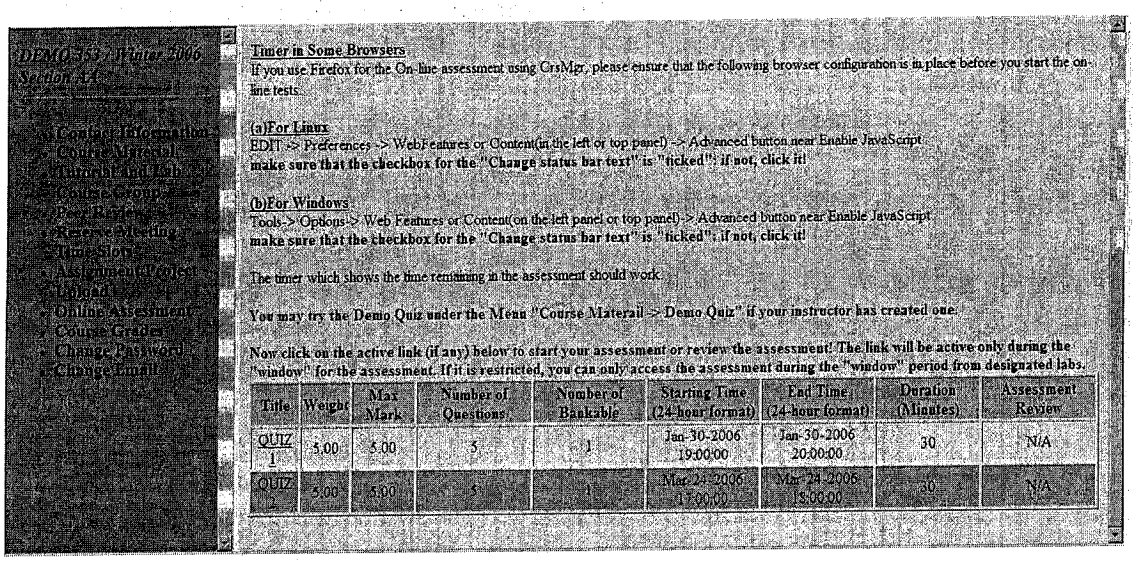


Figure 4.164 List of Online Assessment

There are two types of online assessment questions: normal question and multiple choice question. A normal question may require a short answer, for which the students could either type their answers in a text box or upload a file for more detail answer. The answer file could be in any format including a tar-ball. Each question could have multiple versions and include images. Each version of a multiple choice question could have any number of choices and correct answers.

4.7.8.1 Start an assessment

To start an online assessment, click on the active title link of that assessment (see Figure 4.164); a new window will be opened to show the first randomly chosen question of the assessment. A timer will start to display the time left for the assessment at the status bar of the assessment window (see Figure 4.165). The timer would continue to run if the assessment window is closed by the user or by accident. Once the timer reaches 0, the assessment will be terminated and the assessment window will be closed. A student could resume her assessment within the assigned time limit after he is disconnected from the system. Each time the student resume her assessment, the question in progress on disconnection will be displayed again.

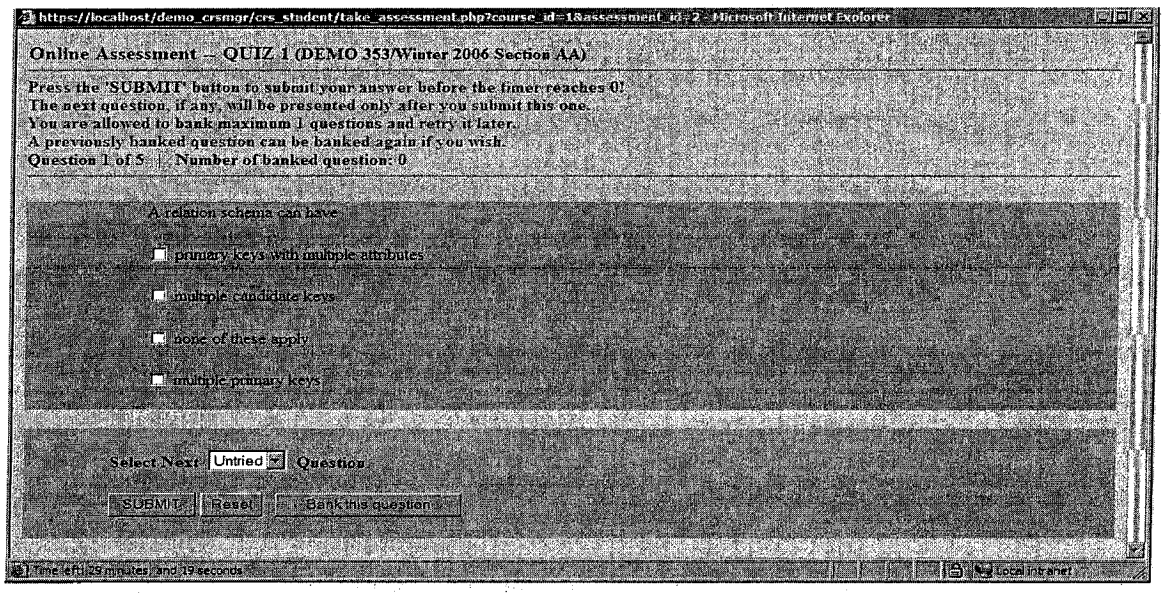


Figure 4.165 Online Assessment Window

During an assessment, the students are required to attempt one question at a time; the next question is presented to the student only after the current question is completed. The questions and the answers are shuffled for each student since each question could have multiple versions. The specific version posed to a given student is randomly selected. As

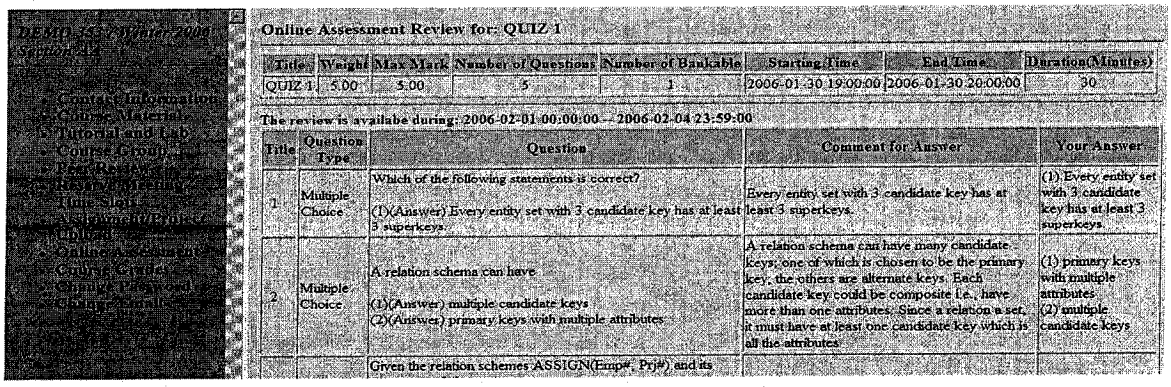
a result, the exam pattern is always different for each student; this greatly reduces the possibility of cheating by a group of students.

4.7.8.2 Bank/defer a question during the assessment

The instructor might allow the students to bank one or more questions to try later during their assessment. To bank an assessment question, click on the "Bank this question" button shown in Figure 4.165. A banked question will be skipped and put in the "Untried" waiting list (see Figure 4.165) that is to be chosen for the next question to be shown. To retry a banked question, the student could either select it from the pull down waiting list as the next question or wait for the system to pick it again randomly once all other questions have been answered. A banked question could be re-banked during a subsequent attempt.

4.7.8.3 Review an assessment

After an online assessment has been completed by the students, the Instructor may allow the students to review their performance on the assessment and check the correct answers during a preset time window. Click on the "Review" link available to show the page for an assessment review (see Figure 4.166).



Online Assessment Review for: QUIZ 1

Title	Weight	Max Mark	Number of Questions	Number of Bankable	Starting Time	End Time	Duration(Minutes)
QUIZ 1	5.00	5.00	5	1	2006-01-30 19:00:00	2006-01-30 20:00:00	30

The review is available during: 2006-02-01 00:00:00 -- 2006-02-04 23:59:00

Title	Question Type	Question	Comment for Answer	Your Answer
1	Multiple Choice	Which of the following statements is correct? (1)(Answer) Every entity set with 3 candidate key has at least 3 superkeys.	Every entity set with 3 candidate key has at least 3 superkeys.	(1) Every entity set with 3 candidate key has at least 3 superkeys.
2	Multiple Choice	A relation schema can have (1)(Answer) multiple candidate keys (2)(Answer) primary keys with multiple attributes	A relation schema can have many candidate keys, one of which is chosen to be the primary key, the others are alternate keys. Each candidate key could be composite i.e., have more than one attributes. Since a relation a set, it must have at least one candidate key which is all the attributes	(1) primary keys with multiple attributes (2) multiple candidate keys
		Given the relation schemes ASSIGN(Emp#, Prj#) and its		

Figure 4.166 Online Assessment Review

4.7.9 Course Grades

Click on the "Course Grades" link in the left frame of the pages for the Course Student; the page showing the course grades for the student is displayed (see Figure 4.167). A "Help for Marking Policy" link is linked to the help page which explains the detail marking policy.

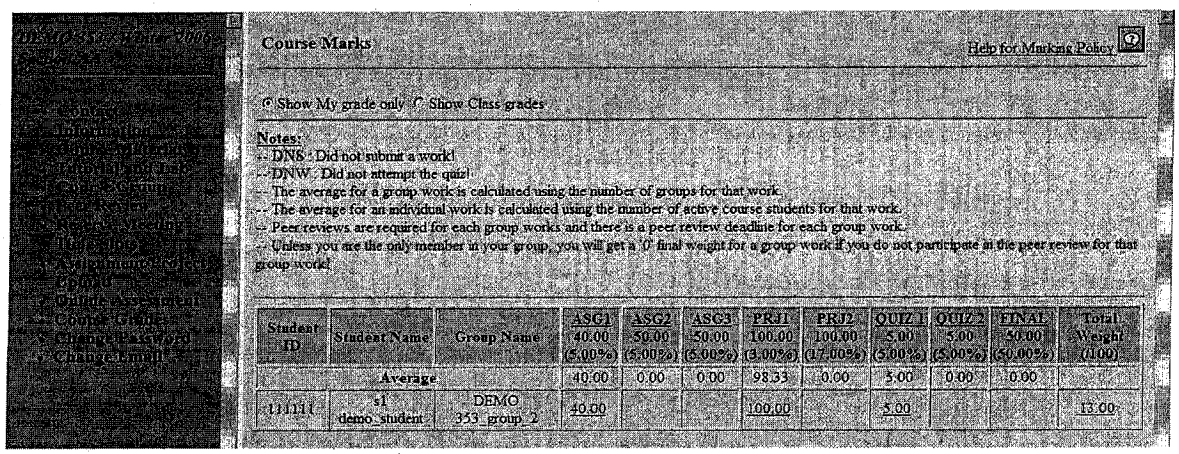


Figure 4.167 Course Grades

Click on a course mark; a new window will be opened to display the detail calculations and the marker's comments on the mark (see Figure 4.168).

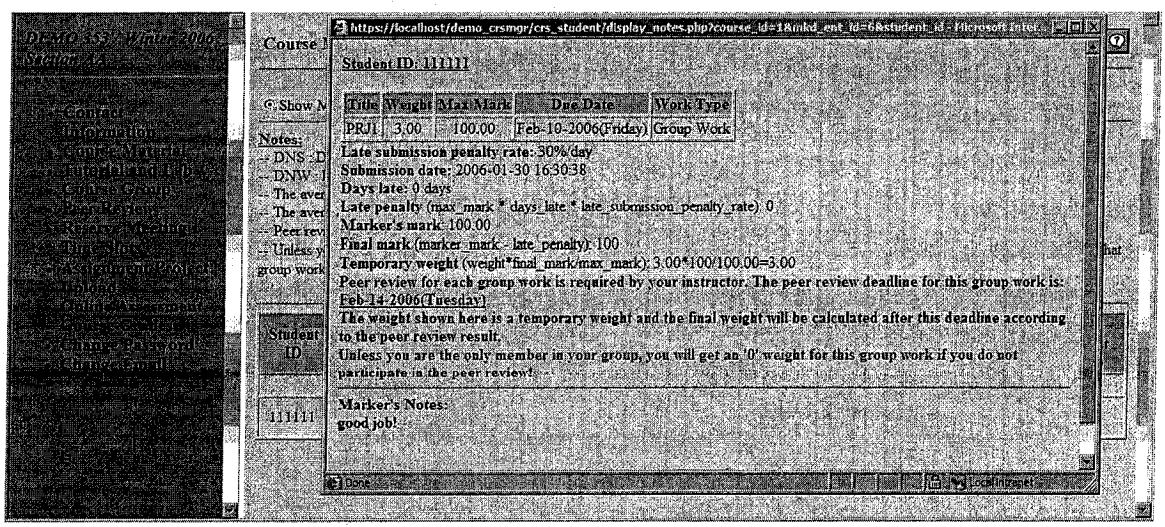
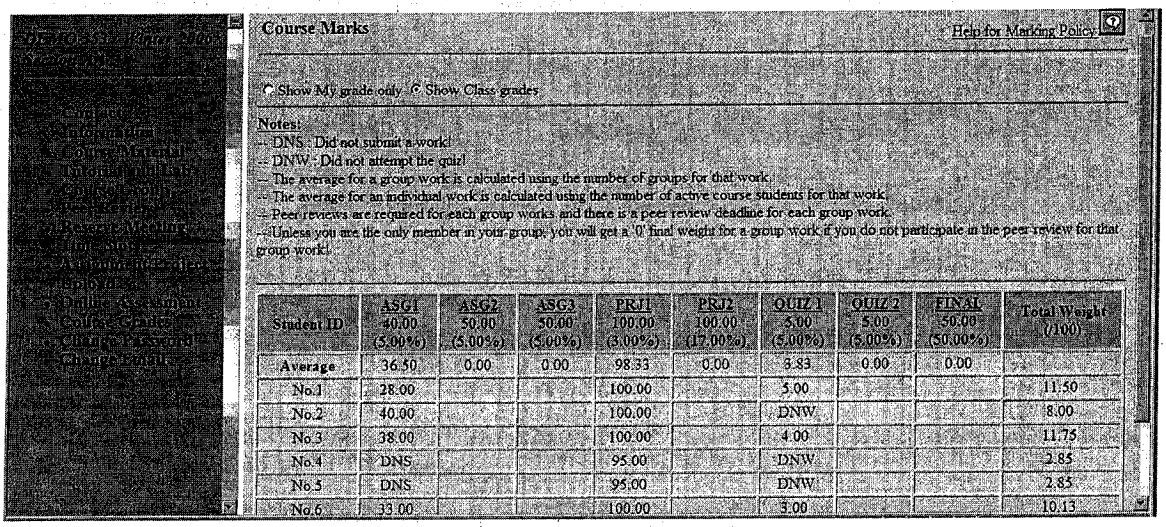


Figure 4.168 Comments on the mark

If it's set by the course instructor, a course student may be able to view the course grades of the whole class by selecting the "show class grades" option (see Figure 4.167). At the end of the term, if it's set by the course instructor, a course student may be able to view the final letter grade and the distribution of the whole class's final letter grades.



Student ID	ASG1 40.00 (5.00%)	ASG2 50.00 (5.00%)	ASG3 50.00 (5.00%)	PRJ1 100.00 (3.00%)	PRJ2 100.00 (17.00%)	QUIZ 1 5.00 (5.00%)	QUIZ 2 5.00 (5.00%)	FINAL 50.00 (50.00%)	Total Weight (/100)
Average	36.50	0.00	0.00	98.33	0.00	3.83	0.00	0.00	
No.1	28.00			100.00		5.00			11.50
No.2	40.00			100.00		DNW			8.00
No.3	38.00			100.00		4.00			11.75
No.4	DNS			95.00		DNW			2.85
No.5	DNS			95.00		DNW			2.85
No.6	33.00			100.00		3.00			10.13

Figure 4.169 Show Class Grades

4.8 Course Marker

The Course Marker accesses the course section that he/she works for and helps the Course Instructor to mark the course works. The common features for all TAs have already been discussed in section 4.1.5. The features for changing password and email have already been discussed in section 4.1.1.5 and section 4.1.1.6.

4.8.1 Course Group

Click on the "Course Group" link in the left frame of the pages for the Course Marker; all the existing course groups are listed (see Figure 4.170).

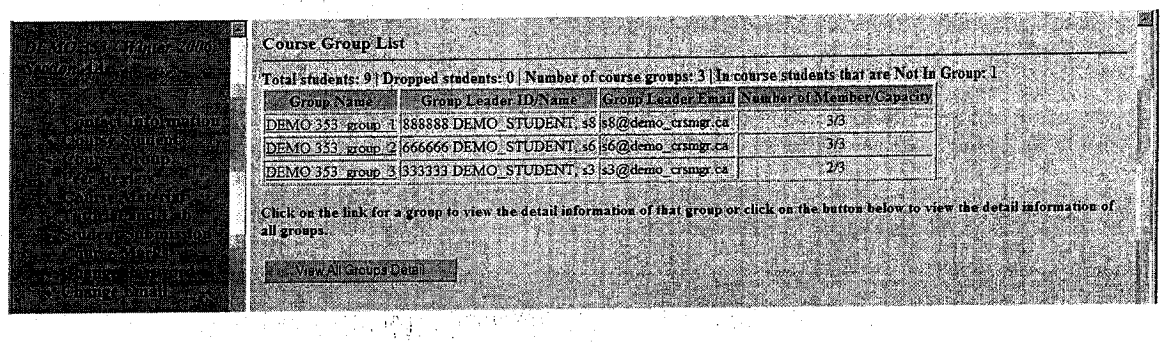


Figure 4.170 Course Group List

To view the detail information of a course group, click on the link on that group name. To view the detail information of all course groups in a page, click on the "View All Groups Detail" button.

4.8.2 Peer Review

This feature is similar as the one discussed in section 4.5.4 for the Course Instructor. However, the Course Marker is not able to set/update the peer review options.

4.8.3 Student Submission

This feature is same as the one discussed in section 4.5.6 for the Course Instructor.

4.8.4 Course Marks

This feature is similar as the one discussed in section 4.5.8 for the Course Instructor. However, the Course Marker is not able to set/update grading schema, to assign final letter grades to the student, and to set mark substitutions.

4.9 Course Tutor

The Course Tutor accesses the course section that he/she works for and helps the Course Instructor to teach the course. The common features for all TAs have already been

discussed in section 4.1.5. The features for changing password and email have already been discussed in section 4.1.1.5 and section 4.1.1.6.

4.10 Lab Tutor

The common features for all TAs have already been discussed in section 4.1.5. The features for changing password and email have already been discussed in section 4.1.1.5 and section 4.1.1.6. The feature for course group is the same as the one discussed in section 4.8.1 for the Course Marker. The feature for meeting time slot is the same as the one discussed in section 4.5.12 for the Course Instructor.

4.11 Graduate Student

The Thesis Graduate Student is under the supervision of one or more thesis supervisors. A graduate student is allowed to upload/update files for the projects she is in and download the project files uploaded by the supervisors. The features for changing password and email have already been discussed in section 4.1.1.5 and section 4.1.1.6.

4.11.1 List of Thesis Supervisors

Click on the "Thesis Supervisors" link in the left frame of the pages for the Thesis Graduate; the student's thesis supervisors are listed by the level of thesis.

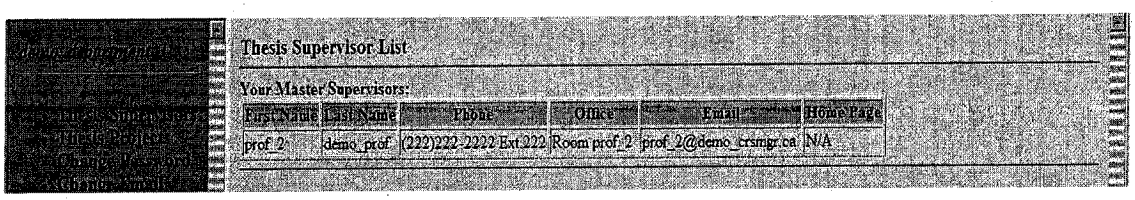


Figure 4.171 List of Thesis Supervisors

4.11.2 Thesis Projects

This feature is similar as the one discussed for the Thesis Supervisor. Please refer to section 4.6.4, section 4.6.7, and section 4.6.10 for references.

Chapter 5

Conclusion and Future Work

5.1 Conclusion

Our goal in this thesis is to develop a web-based course management system for managing teaching relevant tasks and information. In this thesis, we have described the architecture, database design and system functionalities of CrsMgr.

To reach our goal, we first analyzed the problems of the traditional course management tasks. The traditional paper-based management is fairly inefficient and user unfriendly; this motivated us to design and implement a course management system to free course instructors from the inefficient traditional course management. Then we started a major redesign and rebuilt process on the application that's the product of a previous course project. During the rebuilt process of CrsMgr, the system has been used to manage a number of courses including COMP 352, COMP353, COMP451, and Comp5531 in Concordia University. The online assessment system has been used successfully many times to support over 120 concurrent student users in a lab environment as well as an open access. Based on the valuable user feedbacks, the system has been fine tuned during the past 2 years. After around 418 files and 209000 lines of codes were written, the new version of CrsMgr is released with greatly enhanced usability and reliability.

5.2 Contribution of This Thesis

The redesign and implementation of the new CrsMgr system is the main contribution of this thesis. Compared to the previous versions, many new features and improvements to the existing features are added to the system. In the old versions, the feature of multiple access roles for a user was not implemented; to have multiple access privileges, a user needs to be assigned a separate user account for each access role. In the present version of CrsMgr, which is designed with RBAC method, a user could have multiple access privileges using a single user account. Six new access roles have been added to the system for a total of 10 access roles in the present version of CrsMgr; these are: System Administrator, Department Administrator, Course Coordinator, Course Instructor, Thesis Supervisor, Course Student, Course Marker, Course Tutor, Lab Tutor, and Graduate Student. The system provides a wide range of functionalities for these roles and a user could only access the functionalities associated with his assigned role(s). This design of the role separation technique enhances the security and performance of the system. The multiple sections course coordination and the distinction of individual and group work have been realized in the current version of the system. The features for the online course material, the online assignment/project submission, the online assessments, and the online course mark grading are important advantages over the traditional course management. To ease the jobs of the instructors, question banks are provided to store the assessment questions that could be reused for the future assessment creation. The course group management, which introduces the online group-forming, group leader voting and peer-review features, has provided to both the instructors and the students more flexible choices when dealing with management and functioning of course groups. The grading

system has been improved with the options of error correction for assessments, mark substitution, and group work evaluation based on peer review(s). To reduce the possibility of cheating during an online assessment, both the question version and answer are shuffled. Based on the feedback from the student users, the online assessment system is improved to allow the students to defer or bank some of the questions during an online assessment; the deferred questions could be retried later within the assigned time limit. In addition, for an online assessment, an instructor is able to set special time windows and exam durations for the students who are in special needs. Furthermore, the user interfaces are designed using template, which makes the system more user-friendly. The online help pages and instructions help the user on all pages of the system. In conclusion, the new CrsMgr has been improved substantially on both the usability and reliability.

5.3 Future Work

Until now, the design and implementation of CrsMgr is focused on the improvements of features and performance reliability. There are still several directions which could be our future work. Firstly, CrsMgr could be more user-friendly by adding context-sensitive helps and powerful searching features. Second, to further enhance the usability of CrsMgr, more new features are needed. For example, a suitable online WYSWYG text editor, a more powerful online calendar, and an online forum for the communication purpose are the common trends for web-based applications. Finally, the interaction between the CrsMgr system and the users could be more automatic. For instance, an email could be sent by the system automatically to each student to remind them the due date of a project a few days before the due day. Some scripts that are run on the background should be able to do these jobs. Due to the resources limit of this thesis

project, we are unable to fill all these gaps to further enhance the CrsMgr system, and we leave them as the possible future projects for CrsMgr.

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Appendix – Database Tables

The schema and the roles of the tables used in CrsMgr are given below in alphabetic order. Their interaction is explained and the ER diagrams are given in Figure 4.1 to Figure 4.5.

Field	Type	Null	Key	Default	Extra
user_id	int(11)	YES	PRI	0	
role_id	int(11)		PRI	0	

Table 1: ***access***

The ***access*** table defines the many to many relationships between the system users and the access roles. A user could have multiple access roles. The primary key ***user_id*** is a foreign key from the ***user*** table. The attribute ***role_id*** is a foreign key from the ***role*** table.

Field	Type	Null	Key	Default	Extra
email_id	int(11)		PRI	NULL	auto_increment
message_type	varchar(50)				
subject	varchar(80)				
message	text				

Table 2: ***account_email***

The ***account_email*** table stores the system emails to be sent to the users when certain events occur. For example, when a student is inserted into a course, a system email containing the user account information will be sent to his/her email address automatically by the system. The attribute ***message_type*** indicates the type of the email according to the different type of the events. Currently, there are 13 predefined system emails, and their ***email_id***s are defined in the sources file "gen_include.php".

Field	Type	Null	Key	Default	Extra
assessment_id	int(11)		PRI	NULL	auto_increment
mkd_ent_id	int(11)		MUL	0	
title	varchar(50)				
start_time	date_time			0000-00-00 00:00:00	
end_time	date_time			0000-00-00 00:00:00	
time	int(11)			0	
num_questions	int(11)			0	
num_bankable	int(11)	YES		0	
is_online	tinyint(1)			1	
mark_adjustment_question_ids	varchar(80)	YES		NULL	
adjustment_reason	text	YES		NULL	

Table 3: ***assessment***

The ***assessment*** table stores the information for the course assessments. The attribute ***mkd_ent_id*** is a foreign key from the ***marked_entity*** table. The attribute ***time*** indicates the duration of the assessment in minutes. The attribute ***num_bankable*** indicates the maximum number of questions that can be banked for a later try during the assessment. The attribute ***is_online*** indicates whether it's an online or written one (traditional paper exam). By default, the assessment is an online one. Sometimes the multiple choice questions of an assessment might contain errors such as wrong answers. When this happens, the instructors could let the system make the adjustments to the students' marks by making a setting of mark adjustments. The attribute ***marke_adustement_question_ids*** indicates the ids of the questions that are involved in the mark adjustments, and the attribute ***adjustment_reason*** records the reason for the mark adjustments.

Field	Type	Null	Key	Default	Extra
question_id	int(11)		PRI	0	
assessment_id	int(11)		MUL	0	
user_id	int(11)		PRI	0	
file_name	varchar(80)				
md5	varchar(150)				

Table 4: ***assessment_answer_file***

The ***assessment_answer_file*** table stores the user uploaded files during an online assessment. The attributes ***question_id***, ***assessment_id,*** and ***user_id*** are foreign keys from the ***assessment_question*** table, the ***assessment*** table, and the ***user*** table respectively. The attribute ***md5*** records the fingerprint of the uploaded file for later verification purpose. This signature is displayed and emailed to the students so the students cannot challenge the originality of the file.

Field	Type	Null	Key	Default	Extra
choice_id	int(11)		PRI	NULL	auto_increment
question_id	int(11)		MUL	0	
text	text	YES		NULL	
ans_image	varchar(50)	YES		NULL	
is_correct	tinyint(1)			0	

Table 5: ***assessment_choice***

The ***assessment_choice*** table stores the information for the answer choices for the multiple choice questions. One question could have 3 or more choices and more than 1 correct answer. The attribute ***question_id*** is a foreign key from the ***assessment_question*** table. The attribute ***ans_image*** indicates the file name of the image contained in the choices. The attribute ***is_correct*** indicates whether it is a correct choice.

Field	Type	Null	Key	Default	Extra
question_id	int(11)		PRI	NULL	auto_increment
template_id	int(11)		MUL	0	
version	int(11)			0	
creator_id	int(11)		MUL	0	
create_time	date_time			0000-00-00 00:00:00	
q_text	text				
q_image	varchar(50)	YES		NULL	
comment	text	YES		NULL	

Table 6: ***assessment_question***

The ***assessment_question*** table stores the information for the assessment questions. One question template could have multiple question versions. The attribute ***template_id*** is a

foreign key from the ***assessment_question_template*** table. The attribute ***creator_id*** is another foreign key which references the primary key ***user_id*** from the ***user*** table. The attribute ***q_image*** indicates the file name of the image contained in the question. The attribute ***comment*** stores the explanations about the question and the answer.

Field	Type	Null	Key	Default	Extra
template_id	int(11)		PRI	NULL	auto_increment
assessment_id	int(11)		MUL	0	
type	tinyint(1)			0	
title	varchar(50)				
answer_by_file	tinyint(1)	YES		NULL	
num_of_choice	int(11)	YES		NULL	
num_of_answer	int(11)	YES		NULL	
max_mark	float	YES		NULL	

Table7: ***assessment_question_template***

The ***assessment_question_template*** table stores the information for the assessment question templates. The attribute ***assessment_id*** is a foreign key from the ***assessment*** table. An assessment could contain both normal and multiple-choice questions. The attribute ***type*** indicates whether the question is a normal or multiple-choice question. A question template could have multiple question versions. For normal questions, users could be able to upload their answers by file if the ***answer_by_file*** attribute is set to 1. Each multiple-choice question could have more than 4 answer choices and more than 1 correct answer.

Field	Type	Null	Key	Default	Extra
assessment_id	int(11)		PRI	0	
start_time	datetime			0000-00-00 00:00:00	
end_time	datetime			0000-00-00 00:00:00	
enabled	tinyint(1)			1	

Table 8: ***assessment_review***

The instructor could set up a time window for students to review an assessment. The attribute ***assessment_id*** is a foreign key from the ***assessment*** table. The attributes ***start_time*** and ***end_time*** together define the time window. The attribute ***enable*** is a switch to turn on or turn off the review window.

Field	Type	Null	Key	Default	Extra
assessment_id	int(11)		PRI	0	
student_id	int(11)		PRI	0	
start_time	datetime			0000-00-00 00:00:00	
end_time	datetime			0000-00-00 00:00:00	
time	int(11)			0	

Table 9: ***assessment_special_arrangement***

For the students who have special needs, especially those disabled students, the instructor could set up a special time window and a different duration for taking the assessment. The attribute ***assessment_id*** is a foreign key from the ***assessment*** table. The attribute ***student_id*** is also a foreign key from the ***student*** table. The attributes ***start_time*** and ***end_time*** together define the special time window. The attribute ***time*** define the special duration of the assessment.

Field	Type	Null	Key	Default	Extra
choice_id	int(11)		PRI	NULL	auto_increment
question_id	int(11)		MUL	0	
text	text	YES		NULL	
ans_image	varchar(50)	YES		NULL	
is_correct	tinyint(1)			0	

Table 10: ***bank_choice***

This table stores the information for the answer choices for the multiple choice questions in the question bank. A question could have more than 4 choices and more than 1 correct answer. The attribute ***question_id*** is a foreign key from the ***bank_question*** table. The

attribute ***ans_image*** indicates the file name of the image contained in the choices. The attribute ***is_correct*** indicates whether it is a correct choice.

Field	Type	Null	Key	Default	Extra
question_id	int(11)		PRI	NULL	auto_increment
template_id	int(11)		MUL	0	
version	int(11)			0	
creator_id	int(11)		MUL	0	
create_time	date_time			0000-00-00 00:00:00	
q_text	text				
q_image	varchar(50)	YES		NULL	
comment	text	YES		NULL	

Table 11: ***bank_question***

The ***bank_question*** table stores the information for the assessment questions in the question bank. One question template could have multiple question versions. The attribute ***template_id*** is a foreign key from the ***bank_question_template*** table; it indicates the id of the question template that the question belongs to. The attribute ***creator_id*** is another foreign key which references the primary key ***user_id*** from the ***user*** table. The attribute ***q_image*** indicates the file name of the image contained in the question body. The attribute ***comment*** stores the explanations on the question and the answer.

Field	Type	Null	Key	Default	Extra
template_id	int(11)		PRI	NULL	auto_increment
question_topic_id	int(11)		MUL	0	
type	tinyint(1)			0	
title	varchar(50)				
answer_by_file	date_time	YES		NULL	
num_of_choice	text	YES		NULL	
num_of_answer		YES		NULL	
max_mark	float	YES		NULL	

Table 12: ***bank_question_template***

The ***bank_question_template*** table stores the information for the assessment question templates in the question bank. The attribute ***question_topic_id*** is a foreign key from the

question_topic table; it indicates the question topic under which the question is stored. The attribute ***type*** indicates whether the question is a normal or multiple-choice question. A question template could have multiple question versions. For normal questions, users might be able to upload their answers by file if the ***answer_by_file*** attribute is set to 1. Each multiple-choice question could have more than 4 answer choices and more than 1 correct answer.

Field	Type	Null	Key	Default	Extra
course_id	int(11)		PRI	NULL	auto_increment
course_session_id	int(11)		MUL	0	
section	varchar(10)				
self_managed	tinyint(1)			0	
expiry_date	date	YES		NULL	
late_submission_penalty	tinyint(2)			25	
show_class_grade	tinyint(1)			0	
grade_schema_option	tinyint(1)			1	
show_letter_grade	tinyint(1)			0	
join_group_deadline	datetime	YES		NULL	
max_group_member	int(11)	YES		NULL	
choose_leader_deadline	datetime	YES		NULL	
choose_tutorial_time_slot_deadline	datetime	YES		NULL	
vote_num_of_tutorial	int(2)	YES		NULL	
tutorial_is_voted	tinyint(1)	YES		0	
choose_lab_time_slot_deadline	datetime	YES		NULL	
vote_num_of_tutorial	int(2)	YES		NULL	
lab_is_voted	tinyint(1)	YES		0	

Table 13: ***course***

The ***course*** table stores information for a specific course section. The primary key ***course_id*** identifies a unique course section defined by the course name, the year, the term, and the section name. The attribute ***course_session_id*** is a foreign key from the ***course_session*** table; it indicates the course session (year and term) of the course. The attribute ***section*** indicates the section name of the course. The attribute ***self_managed*** indicates whether the course instructor is allowed to create course marked entities such as

assignments, projects, and quizzes. The attribute ***expiry_date*** defines the last date that the course students can access the course pages. The attribute ***late_submission_penalty*** indicate the penalty rate to the late submission of assignments or projects. The attribute ***show_class_grade*** indicate whether to show course marks of the whole class to the students. The attribute ***grade_schema_option*** indicates the type of the final letter grade (A+ to F or Pass/Fail). The attribute ***show_letter_grade*** indicates whether to show final letter grade to the students. The attribute ***join_group_deadline*** and ***choose_leader_deadline*** indicate the deadlines for the students to join a project group and to choose a group leader. The attribute ***max_group_member*** defines the maximum number of group member. The attribute ***choose_tutorial_time_slot_deadline*** and ***choose_lab_time_slot_deadline*** indicate the deadlines for the students to vote for the final time slots for the tutorials and labs. The attribute ***vote_num_of_tutorial*** and ***vote_num_of_lab*** indicate the number of final time slots to be chosen for the tutorials and labs. The attribute ***tutorial_is_voted*** and ***lab_is_voted*** indicate whether the tutorial and lab time slots have been voted.

Field	Type	Null	Key	Default	Extra
course_session_id	int(11)		PRI	0	
professor_id	int(11)		MUL	0	

Table 14: ***course_coordinator***

The ***course_coordinator*** table describes the many to one relationship between course sections under the same session and coordinators. A course coordinator might also be the instructor of several sections. The primary key ***course_session_id*** is a foreign key from the ***course_session*** table. The attribute ***professor_id*** is another foreign key from the ***professor*** table.

Field	Type	Null	Key	Default	Extra
course_desc_id	int(11)		PRI	NULL	auto_increment
course_number	varchar(15)		UNI		
course_name	varchar(80)				
department_id	int(11)		MUL	0	
course_level	tinyint(1)				

Table 15: ***course_desc***

The ***course_desc*** table contains the course numbers and course names for all the courses. The attribute ***department_id*** is a foreign key from the ***department*** table; it indicates the unique department that the course belongs to. The attribute ***course_level*** indicates whether the course is an undergraduate or a graduate course.

Field	Type	Null	Key	Default	Extra
group_id	int(11)		PRI	NULL	auto_increment
course_id	int(11)		MUL	0	
group_name	varchar(50)				
leader_student_id	int(11)	YES	MUL	NULL	
project_password	varchar(20)	YES		NULL	
is_locked	tinyint(1)			1	

Table 16: ***course_group***

The ***course_group*** table contains information about course project groups. A project group belongs to a unique course section identified by the foreign key ***course_id*** which comes from the ***course*** table. Another foreign key ***leader_student_id*** identifies the student_id of the group leader and could be null. The attribute ***project_password*** records the password for the group project when it's necessary. The attribute ***is_locked*** indicates whether the group has been locked by the group members so that no other students can join this group.

Field	Type	Null	Key	Default	Extra
course_id	int(11)		PRI	0	
professor_id	int(11)		MUL	0	

Table 17: ***course_professor***

The ***course_professor*** table describes the many to one relationship between course sections and course instructors. A course instructor might be the instructor of several sections. The primary key ***course_id*** is a foreign key from the ***course*** table. The attribute ***professor_id*** is a foreign key from the ***professor*** table.

Field	Type	Null	Key	Default	Extra
course_session_id	int(11)		PRI	NULL	auto_increment
course_desc_id	int(11)		MUL	0	
year	int(11)			0	
session	tinyint(2)			0	

Table 18: ***course_session***

The ***course_session*** table stores information about course sessions. The attribute ***course_desc_id*** is a foreign key from the ***course_desc*** table. The attribute ***year*** defines the course year and the attribute ***session*** defines the course term -- fall, winter or summer. The session is coded and the values for fall term, winter term, and summer are 2, 4, and 1 respectively.

Field	Type	Null	Key	Default	Extra
course_student_id	int(11)		PRI	NULL	auto_increment
course_id	int(11)		MUL	0	
student_id	int(11)		MUL	0	
letter_grade	varchar(30)	YES		NULL	
enabled	tinyint(1)			1	

Table 19: ***course_student***

The ***course_student*** table defines the many to many relationships between the course sections and the students. A student might have taken several courses at the same time. The attributes ***course_id*** and student_id are foreign keys from the ***course*** table and the ***student*** table respectively. The attribute ***letter_grade*** store the final letter grade for the student of the course. The attribute ***enabled*** indicates the in-course status of the student. A course student could be in one of the three statuses: Active, Suspended, and Dropped.

Field	Type	Null	Key	Default	Extra
department_id	int(11)		PRI	NULL	auto_increment
department_name	varchar(80)		UNI		
home_page	varchar(100)	YES	MUL	NULL	

Table 20: ***department***

The ***department*** table contains the information for the departments.

Field	Type	Null	Key	Default	Extra
professor_id	int(11)		PRI	0	
department_id	int(11)		MUL	0	

Table 21: ***department_manager***

The ***department_manager*** table describes the one to many relationships between the departments and the professors. A professor could be the department administrator of CrsMgr of only one department. The primary key ***professor_id*** is a foreign key from the ***professor*** table. The attribute ***department_id*** is a foreign key from the ***department*** table.

Field	Type	Null	Key	Default	Extra
course_id	int(11)		PRI	0	
letter	varchar(30)		PRI		
low	float(6,2)		PRI	0.00	
high	float(6,2)		PRI	0.00	

Table 22: ***grade_schema***

The ***grade_schema*** table defines the relationships between the letter grades and the mark ranges for a course. Each course section can have its own grading schema. The attribute ***course_id*** is a foreign key from the ***course*** table. The attribute ***letter*** refers to the letter grade. The attributes ***low*** and ***high*** together define the mark range corresponding to the ***letter*** grade.

Field	Type	Null	Key	Default	Extra
vote_id	int(11)		PRI	NULL	auto_increment
voter_id	int(11)		MUL	0	
candidate_id	int(11)		MUL	0	
group_id	int(11)		MUL	0	
rank	tinyint(1)			0	

Table 23: ***group_leader_vote***

The ***group_leader_vote*** table stores the vote information for the group leaders. Students are required to choose a group leader for their project groups by ranking their preference. The attribute ***voter_id*** defines the student who was voting. The attribute ***rank*** defines the votes ranking of the candidate indicated by the ***candidate_id***. The two attributes ***voter_id*** and ***candidate_id*** are both foreign keys from the ***student*** table. The attribute ***group_id*** is also a foreign from the ***course_group*** table.

Field	Type	Null	Key	Default	Extra
group_id	int(11)		PRI	0	
student_id	int(11)		PRI	0	

Table 24: ***group_member***

This table defines the many to many relationships between students and their project groups. The attributes ***group_id*** and ***student_id*** are two foreign keys from the ***course_group*** table and the ***student*** table respectively.

Field	Type	Null	Key	Default	Extra
course_id	int(11)		PRI	0	
referenced_id	int(11)		MUL	0	
substitution_ids	varchar(100)				
enabled	tinyint(1)			1	

Table 25: ***mark_substitution***

The ***mark_substitution*** table stores the mark substitution setting for a course. The instructors may create and apply the "mark substitution policy" to calculate the students' final weights. If a student performed better in the "Final Exam" than in at least one of the

marked entities within a chosen set for substitution, then that entity's mark is replaced by the prorated mark based on the student's performance in the "Final Exam". The primary key ***course_id*** is a foreign key from the ***course*** table. The attribute ***referenced_id*** is also a foreign key from the ***marked_entity*** table; it indicates the referenced "Final Exam". The ***substitution_ids*** indicates the ids of the marked entities to be substituted.

Field	Type	Null	Key	Default	Extra
mkd_ent_id	int(11)		PRI	NULL	auto_increment
type	varchar(50)	YES		NULL	
name	varchar(50)				
weight	float(5,2)			0.00	
max_mark	float(6,2)			0.00	
due_date	date	YES		NULL	
file_name	varchar(30)	YES		NULL	
post_time	datetime			0000-00-00 00:00:00	
is_group_work	tinyint(1)			0	
shared	tinyint(1)			0	
enabled	tinyint(1)			1	
course_session_id	int(11)	YES	MUL	NULL	

Table 26: ***marked_entity***

The ***marked_entity*** table contains information for all course marked entities, such as assignments, projects and quizzes. The attribute ***type*** indicates the type of the marked entity (assignment, project, quiz, demo_quiz). The attribute ***weight*** is the percentage of the marked entity. The entity (assignment or project) may have a submission ***deadline***. The attribute ***file_name*** refers to the file uploaded by instructors and the attribute ***post_time*** records the time that the marked entity was posted. The attribute ***is_group_work*** tells whether it's an individual or group work. To tell whether the marked_entity is created for the whole course session or for specific section, the ***shared*** attribute is used. If a marked entity is shared, the ***course_session_id*** is recorded. The

relationship between shared marked entity and course session is many to one. A marked entity is accessible only when the attribute ***enabled*** is set to 1.

Field	Type	Null	Key	Default	Extra
time_slot_id	int(11)		PRI	NULL	auto_increment
course_id	int(11)		MUL	0	
meeting_date	date			0000-00-00	
start_time	time			00:00:00	
end_time	time			00:00:00	
purpose	tinyint(1)			0	
reserved	tinyint(1)			0	

Table 27: ***meeting_time_slot***

The ***meeting_time_slot*** table stores the meeting time slots for a course. The attribute ***course_id*** is a foreign key from the ***course*** table. The attributes ***meeting_date, start_time,*** and ***end_time*** together define a time slot. The attributes ***purpose*** indicates the type of a time slot – consultation, individual demo or group demo. The attribute ***reserved*** indicates whether a time slot has been reserved.

Field	Type	Null	Key	Default	Extra
mkd_ent_id	int(11)		PRI	0	
group_id	int(11)		PRI	0	
mark	float(6,2)			0.00	
notes	text	YES		NULL	
course_id	int(11)		MUL	0	
feedback_file	varchar(80)	YES		NULL	

Table 28: ***mkd_grade_group***

The ***mkd_grade_group*** table stores the group grades for each group work. The attributes ***mkd_ent_id*** and ***group_id*** are two foreign keys from the ***marked_entity*** table and the ***course_group*** table respectively. The attribute ***course_id*** is also a foreign key from the table ***course***. The attribute ***feedback_file*** refers to the marker's feedback file for the group work.

Field	Type	Null	Key	Default	Extra
mkd_ent_id	int(11)		PRI	0	
student_id	int(11)		PRI	0	
mark	float(6,2)			0.00	
notes	text	YES		NULL	
course_id	int(11)		MUL	0	
group_id	int(11)	YES	MUL	NULL	
feedback_file	varchar(80)	YES		NULL	
dnw_quiz	Tinyint(1)			0	

Table 29: ***mkd_grade_individual***

The ***mkd_grade_individual*** table stores the grades for each student for all the group/individual marked entities. The attributes ***mkd_ent_id*** and ***student_id*** are two foreign keys from the ***marked_entity*** table and the ***student*** table respectively. If the grade is for a group marked entity, the foreign key ***group_id*** identities the group to which the grade was assigned. The attribute ***feedback_file*** refers to the marker's feedback file for the group work. The attribute ***dnw_quiz*** is a flag to indicate whether a student has attended a written quiz.

Field	Type	Null	Key	Default	Extra
mkd_ent_id	int(11)		PRI	0	
course_id	int(11)		PRI	0	

Table 30: ***overrided_common_marked_entity***

The session common marked entities are accessible to all course sections by default. However, the instructors of the self_managed course sections, who are allowed to create their own course marked entities, can decide whether to use some or all of these session common marked entities. If these common marked entities are disabled by the section instructors, they are indicated in this table. The two attributes ***mkd_ent_id*** and ***course_id*** are foreign keys from the ***marked_entity*** table and the ***course*** table respectively.

Field	Type	Null	Key	Default	Extra
material_id	int(11)		PRI	0	
course_id	int(11)		PRI	0	

Table 31: ***overrided_common_teaching_material***

The session common teaching materials are accessible to all course sections by default. However, the instructors of self_managed course sections can decide whether to use these session common teaching materials. If these common teaching materials are disabled by the section instructors, they are indicated in this table. The two attributes ***mateial_id*** and ***course_id*** are foreign keys from the ***teaching_material*** table and the ***course*** table respectively.

Field	Type	Null	Key	Default	Extra
user_id	int(11)		PRI	0	
user_tokens	varchar(15)				
expiry_date	datetime	YES		NULL	

Table 32: ***password_tokens***

The users are allowed to reset their password if they forget their original one. Once they can correctly answer the secret questions, a reset password link containing a token will be sent to the user's email address. The ***user_token*** is valid before the ***expriy_date***. The attribute ***user_id*** is a foreign key from the ***user*** table.

Field	Type	Null	Key	Default	Extra
group_id	int(11)		PRI	0	
mkd_ent_id	int(11)		PRI	0	
student_id	int(11)		PRI	0	
reviewer_id	int(11)		PRI	0	
review_score	int(3)			0	
comments	text	YES		NULL	

Table33: ***peer_review_full***

The course instructors might require the students to make one peer review for each group work. The attribute ***mkd_ent_id*** identifies the group work for which the peer review is

conducted. The attribute ***student_id*** identifies the student that is given the score. The attribute ***reviewer_id*** identifies the group member that gives the score.

Field	Type	Null	Key	Default	Extra
course_id	int(11)		PRI	0	
peer_review_type	tinyint(1)			0	
remove_extreme	tinyint(1)			0	
threshold_extreme	tinyint(2)			25	
single_peer_review_deadline	date	YES		NULL	
show_scores	tinyint(1)	YES		0	
date_show_scores	date	YES		NULL	
enabled	tinyint(1)			1	

Table 34: ***peer_review_setting***

The course instructors might require the students to grade the relative contribution of each group member for the group works. The attribute ***peer_review_type*** defines the type of the peer review. There are two types of peer reviews that instructors can choose: a single peer review for all group works or peer reviews for each group work. The instructors are allowed to discard the extreme scores by setting the attributes ***remove_extreme*** and ***threshod_extreme***. For the single peer review, a deadline indicated by ***single_peer_review_deadline*** is set by the instructor. The instructor is able to control when to show the evaluation scores to the students by setting the attributes ***show_scores*** and ***date_show_scores***. The attribute ***enabled*** allows the instructor to enable or disable the peer review.

Field	Type	Null	Key	Default	Extra
group_id	int(11)		PRI	0	
student_id	int(11)		PRI	0	
reviewer_id	int(11)		PRI	0	
review_score	int(3)			0	
comments	text	YES		NULL	

Table 35: ***peer_review_single***

The course instructors might require the students to make a single peer review for all the group works at the end of the term. The attribute ***group_id*** identifies the group in which the peer review is conducted. The attribute ***student_id*** identifies the student that is given the score. The attribute ***reviewer_id*** identifies the group member that gives the score.

Field	Type	Null	Key	Default	Extra
professor_id	int(11)		PRI	0	
user_id	int(11)		MUL	0	
department_id	int(11)	YES	MUL	0	

Table 36: ***professor***

The ***professor*** table stores professor information. Other professor information such as name, email and home page has been stored in the ***user*** table. The attribute ***department_id*** identifies the current department that the professor works for. We define that one professor can only work for one department.

Field	Type	Null	Key	Default	Extra
question_id	int(11)		PRI	0	
assessment_id	int(11)		PRI	0	
user_id	int(11)		PRI	0	
is_checked_out	tinyint(1)			0	
is_done	tinyint(1)			0	
order_number	tinyint(2)			0	

Table37: ***question_deferred***

The ***question_deferred*** table stores information of the deferred (banked) questions during an assessment. Students might be allowed to defer/bank more than one question during an exam to try later. The foreign key ***question_id*** identifies the question that is banked, and the foreign key ***assessment_id*** identifies the assessment. The foreign key ***user_id*** identifies the user who is taking the assessment. The attribute ***is_checked_out*** indicates whether the deferred question is checked out to try again. The attribute ***is_done*** indicates whether the deferred question is completed.

Field	Type	Null	Key	Default	Extra
question_id	int(11)		MUL	0	
assessment_id	int(11)		PRI	0	
user_id	int(11)		PRI	0	

Table 38: ***question_inprogress***

The ***question_inprogress*** table stores the question that is being tried by the user during an assessment. The foreign key ***question_id*** identifies the question that is being tried. The foreign key ***user_id*** identifies the user who is taking the assessment. The foreign key ***assessment_id*** identifies the assessment. For each user, there will be at most one question in progress for an assessment.

Field	Type	Null	Key	Default	Extra
question_topic_id	int(11)		PRI	NULL	auto_increment
topic_name	varchar(50)				
objective	text	YES		NULL	
course_desc_id	int(11)		MUL	0	

Table 39: ***question_topic***

The ***question_topic*** table stores information of the topics for the question bank. The attribute ***objective*** describes the objective of the question topic. The foreign key ***course_desc_id*** identifies the course under which the topic was created.

Field	Type	Null	Key	Default	Extra
role_id	int(11)		PRI	0	
role_name	varchar(50)		UNI		
r_description	varchar(80)	YES		NULL	
role_dirname	varchar(20)				
role_default	varchar(50)	YES		NULL	

Table 40: ***role***

The ***role*** table defines the different access roles of the users. One user of the system may have multiple access roles. The attribute ***role_dirname*** records the directory name for the codes of the role. The attribute ***role_default*** records the default php file to be processed when the role link is clicked.

Field	Type	Null	Key	Default	Extra
time_slot_id	int(11)		PRI	0	
group_id	int(11)	YES	MUL	NULL	

Table 41: ***scheduled_meeting_group***

The ***scheduled_meeting_group*** table records the reserved meeting time slots for the course groups. The attribute ***time_slot_id*** is a foreign key from the ***meeting_time_slot*** table. The attribute ***group_id*** is a foreign key from the ***course_group*** table. While one meeting time slot can be reserved by only one course group, one course group can reserve only one "future" time slot.

Field	Type	Null	Key	Default	Extra
time_slot_id	int(11)		PRI	0	
student_id	int(11)	YES	MUL	NULL	

Table 42: ***scheduled_meeting_individual***

The ***scheduled_meeting_individual*** table records the reserved meeting time slots for the students. The attribute ***time_slot_id*** is a foreign key from the ***meeting_time_slot*** table. The attribute ***student_id*** is a foreign key from the ***student*** table. While one meeting time slot can be reserved by only one student, one student can reserve only one "future" time slot of same type.

Field	Type	Null	Key	Default	Extra
question_id	int(11)		PRI	NULL	auto_increment
title	varchar(30)				
q_text	varchar(100)				

Table 43: ***secret_questions***

This ***secret_questions*** table records the secret questions created by the system administrators to show to the users during their first login.

Field	Type	Null	Key	Default	Extra
temail_id	int(11)		PRI	0	
course_id	int(11)		PRI	0	

Table 44: ***section_email***

The ***section_email*** table defines the relationship between the teaching emails sent by the course instructors and the course sections. The attribute ***temail_id*** is a foreign key from the ***teaching_email*** table. The attribute ***course_id*** is a foreign key from the ***course*** table.

Field	Type	Null	Key	Default	Extra
mkd_ent_id	int(11)		PRI	0	
course_id	int(11)		PRI	0	

Table 45: ***section_marked_entity***

The ***section_marked_entity*** table defines the relationships between the marked entities and the course sections that created them. Course instructors of self-managed sections can create their own marked entities. The attribute ***mkd_ent_id*** is a foreign key from the ***marked_entity*** table. The attribute ***course_id*** is a foreign key from the ***course*** table.

Field	Type	Null	Key	Default	Extra
material_id	int(11)		PRI	0	
course_id	int(11)		PRI	0	

Table 46: ***section_material***

The ***section_material*** table defines the relationships between the course materials and the specific course sections that created them. The attribute ***material_id*** is a foreign key from the ***teaching_material*** table. The attribute ***course_id*** is a foreign key from the ***course*** table.

Field	Type	Null	Key	Default	Extra
student_id	int(11)		PRI	0	
user_id	int(11)		MUL	0	
level	tinyint(1)	YES		NULL	

Table 47: ***student***

The ***student*** table stores student information. Other student information such as name, email and home page has been stored in the ***user*** table. A student may have several access roles including course student, markers, tutor, lab_tutor and thesis graduate. Each student has a unique ***user_id*** for all his roles. The attribute ***level*** indicates whether this is an undergraduate or a graduate student.

Field	Type	Null	Key	Default	Extra
student_file_id	int(11)		PRI	NULL	auto_increment
mkd_ent_id	int(11)		MUL	0	
mark_assignee_id	int(11)			0	
file_name	varchar(80)				
md5	varchar(80)				
upload_time	datetime			0000-00-00 00:00:00	

Table 48: ***student_file***

The ***student_file*** table contains the information of the files uploaded by students for marked entities. The ***mark_assignee_id*** is either a *student_id* or a *group_id*, depending on whether the marked entity is a individual work or an group work.

Field	Type	Null	Key	Default	Extra
time_slot_id	int(11)		PRI	NULL	auto_increment
type	varchar(20)				
day	tinyint(1)			0	
start_time	time			00:00:00	
end_time	time			00:00:00	
room	varchar(20)	YES		NULL	
course_id	int(11)		MUL	0	
tutor_sid	int(11)	YES	MUL	NULL	
enabled	tinyint(1)			1	

Table 49: ***ta_time_slot***

The ***ta_time_slot*** table contains the information of the tutorial or lab time slots. The attribute ***type*** indicates whether the time slot is for tutorial or for lab. The attribute ***day*** indicates the week day of the time slot. The attribute ***tutor_sid*** identifies the student_id of the tutor.

Field	Type	Null	Key	Default	Extra
vote_id	int(11)		PRI	NULL	auto_increment
voter_student_id	int(11)		MUL	0	
candidate_time_slot_id	int(11)		MUL	0	
rank	tinyint(1)			0	

Table 50: ***ta_time_slot_vote***

The ***ta_time_slot_vote*** table stores the vote information for the tutorial or lab time slots. Students might be allowed to choose the final time slots from one set of candidate time slots by ranking their preference. The attribute ***voter_student_id*** defines the student who was voting. The attribute ***rank*** defines the ranking of the candidate time slot indicated by the attribute ***candidate_time_slot_id***. The two attributes ***voter_student_id*** and ***candidate_time_slot_id*** are foreign keys from the table ***student*** and the table ***ta_time_slot*** respectively.

Field	Type	Null	Key	Default	Extra
assessment_id	int(11)		PRI	0	
user_id	int(11)		PRI	0	
start_time	int(11)			0	
time_left	int(11)			0	

Table 51: ***take_assessment***

The ***take_assessment*** table stores the information for each user taking an assessment. A user can log out or be disconnected from the system and resume his assessment within the time limit indicated by the ***start_time*** and the ***time_left***. Once the value of attribute ***time_left*** is equal to zero, the assessment will be terminated by the system.

Field	Type	Null	Key	Default	Extra
ta_id	int(11)		PRI	NULL	auto_increment
ta_type	tinyint(1)			0	
course_id	int(11)		MUL	0	
student_id	int(11)		MUL	0	

Table 52: ***teaching_assistant***

The ***teaching_assistant*** table stores the information for course teaching assistants. The attribute ***ta_type*** indicates the type of teaching assistants – tutor, lab instructor, or marker.

Field	Type	Null	Key	Default	Extra
temail_id	int(11)		PRI	NULL	auto_increment
recipient_type	tinyint(2)			0	
subject	varchar(100)				
message	text				
send_time	datetime		MUL	0000-00-00 00:00:00	
sender_user_id	int(11)		MUL	0	
course_session_id	int(11)	YES	MUL	NULL	

Table53: ***teaching_email***

The ***teaching_email*** table contains information about the teaching emails sent by the course professors and coordinators. The attribute ***recipient_type*** indicates the recipient of the email such as all students in section, all group leaders in session, and all instructors in session. If a teaching_email is sent by the coordinator, the ***course_session_id*** is recorded.

Field	Type	Null	Key	Default	Extra
material_id	int(11)		PRI	NULL	auto_increment
type	varchar(50)	YES		NULL	
name	varchar(80)				
file_name	varchar(80)	YES		NULL	
text	text	YES		NULL	
post_time	datetime			0000-00-00 00:00:00	
shared	tinyint(1)			0	
enabled	tinyint(1)			1	
course_session_id	int(11)	YES	MUL	NULL	

Table 54: ***teaching_material***

The ***teaching_material*** table contains the information of the course material created by either the course professors or the coordinators. The attribute ***type*** indicates the type of the material such as course outline, announcement, lecture notes, solution and tutorial. If a teaching material is ***shared***, the ***course_session_id*** is recorded.

Field	Type	Null	Key	Default	Extra
thesis_graduate_id	int(11)		PRI	NULL	auto_increment
student_id	int(11)		MUL	0	
supervisor_id	int(11)		MUL	0	
thesis_level	tinyint(1)			1	
start_date	date	YES		NULL	
end_date	date	YES		NULL	
department_id	int(11)		MUL	0	
enabled	tinyint(1)			1	

Table 55: ***thesis_graduate***

The ***thesis_graduate*** table contains the information of the thesis graduate students together with their supervisors. The attribute ***thesis_level*** indicates the level of thesis – master, Ph.D., or Postdoctoral. The attribute ***department_id*** indicates the department that the supervision belongs to.

Field	Type	Null	Key	Default	Extra
project_id	int(11)		PRI	NULL	auto_increment
project_title	varchar(100)				
project_level	tinyint(1)			1	
project_abstract	text	YES		NULL	
project_status	tinyint(1)			0	
create_date	date	YES		NULL	
creator_id	int(11)		MUL	0	
department_id	int(11)		MUL	0	

Table 56 ***thesis_project***

The ***thesis_project*** table contains the information of the thesis projects. The attribute ***project_level*** indicates the level of project – master, Ph.D., or Postdoctoral. The attribute ***project_status*** indicates the status of project – in progress or completed. The attribute ***creator_id*** indicates the ***user_id*** of the project creator.

Field	Type	Null	Key	Default	Extra
project_file_id	int(11)		PRI	NULL	auto_increment
file_name	varchar(80)				
subject	varchar(100)	YES		NULL	
description	text	YES		NULL	
md5	varchar(80)				
upload_time	datetime			0000-00-00 00:00:00	
project_id	int(11)		MUL	0	
user_id	int(11)	YES	MUL	NULL	

Table 57: ***thesis_project_file***

The ***thesis_project_file*** table stores the information of the uploaded files for thesis projects. The attribute ***project_id*** is a foreign key from the ***thesis_project*** table and identifies the project for which the file was uploaded. The foreign key ***user_id*** records the user who uploaded the file.

Field	Type	Null	Key	Default	Extra
project_id	int(11)		PRI	0	
student_id	int(11)		PRI	0	

Table 58: ***thesis_project_member***

The ***thesis_project_member*** table defines the many to many relationships between thesis projects and thesis graduate students.

Field	Type	Null	Key	Default	Extra
assessment_id	int(11)		PRI	0	
user_id	int(11)		PRI	0	
duration	int(11)			0	
start_time	int(11)			0	
time_left	int(11)			0	

Table 59: ***try_assessment***

The ***try_assessment*** table stores the information for each user who is trying an assessment or demo assessment. Only the instructor and coordinator are allowed to try an assessment. The course student can only try the demo assessments. Users are allowed to set the duration of the assessments. A user can log out and resume his assessment within

the time limit defined by the ***start_time*** and ***time_left***. Once the value of attribute ***time_left*** is equal to zero, the assessment will be terminated by the system.

Field	Type	Null	Key	Default	Extra
user_id	int(11)		PRI	NULL	auto_increment
user_name	varchar(20)		UNI		
password	varchar(20)				
first_name	varchar(30)	YES		NULL	
last_name	varchar(30)	YES		NULL	
phone	varchar(20)	YES		NULL	
extension	varchar(6)	YES		NULL	
office	varchar(50)	YES		NULL	
email	varchar(50)	YES		NULL	
home_page	varchar(100)	YES		NULL	
question_1	varchar(100)	YES		NULL	
answer_1	varchar(30)	YES		NULL	
question_2	varchar(100)	YES		NULL	
answer_2	varchar(30)	YES		NULL	
question_3	varchar(100)	YES		NULL	
answer_3	varchar(30)	YES		NULL	
active	tinyint(1)	YES		1	
identity	tinyint(1)	YES		0	

Table 60: ***user***

The ***user*** table contains the user account information for the CrsMgr System. Each user has his/her unique ***user_name/password*** to log in, even though he/she might have multiple access roles. For example, a student might have registered in a number of courses and works as markers of other courses; a professor might be an instructor of some course sections and the coordinator of some courses. The attribute ***active*** indicates whether the user is in good condition or has been suspended. When a user forgets his password, three challenge questions will be used for validating the users.

Field	Type	Null	Key	Default	Extra
assessment_id	int(11)		PRI	0	
question_id	int(11)		PRI	0	
user_id	int(11)		PRI	0	
text_answer	text	YES		NULL	
choice_ids	varchar(80)	YES		NULL	
score	float	YES		NULL	
comment	text	YES		NULL	

Table61: ***user_answer***

The ***user_answer*** table stores the user answers to the assessment questions. For normal questions, the attribute ***text_answer*** records the text answer input in a text box. For multiple choice questions, the ***choice_ids*** records all the chosen choices for the question. The ***score*** and ***comment*** for each question that is given by the marker are also stored here.